SARMATIAN FORAMINIFERA OF THE ZSÁMBÉK BASIN, HUNGARY

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Abstract

A Sarmatian foraminiferal zonation is presented on the basis of 3 boreholes from the Zsámbék Basin, which cut a Sarmatian sequence, complete in the Hungarian sense. Three zones could be distinguished: Elphidium reginum, Elphidium hauerinum and Spirolina austriaca zone. These could be correlated with the other foraminiferal zones both of the Western and the Eastern Paratethys, furthermore the boundary of Kozárd and Tinnye Substage could be determined. Systematic descriptions are given of 63 species, including 3 new ones. Previously only 18 of them were described from the Sarmatian formations of Hungary.

Introduction

History of development of the Western and the Eastern Paratethys was different during the Sarmatian. For this reason distinct stratigraphic units are used in these two areas of Paratethys (NEVESSKAJA et al. 1989). The classic stratigraphic divisions were based on the mollusch fauna. In the Eastern Paratethys ANDRUSOV (1902) established the Volhynian, Bessarabian and Chersonian Substages, these correspond to the Lower, Middle and Upper Sarmatian. Starting from the upper part of the Bessarabian Substage in the Western Paratethys lacustrine formations deposited, so this stratigraphic unit is called Pannonian Stage while the lower part is named Sarmatian s.str. (SUESS, 1866) in this region. The Sarmatian s.str. was divided into different units by many authors (FUSCH, 1875; WINKLER, 1913; PAPP, 1956; SENEŠ 1972; JIRICEK, 1972 etc.). The Hungarian Sarmatian biostratigraphic division was made by BODA (1959-74). Studying mollusc fauna of Hungary (from the Zsámbék Basin too) he distinguished the Kozárd and Tinnye Substages. The boundary was defined as the time, when the characteristic specimens of the

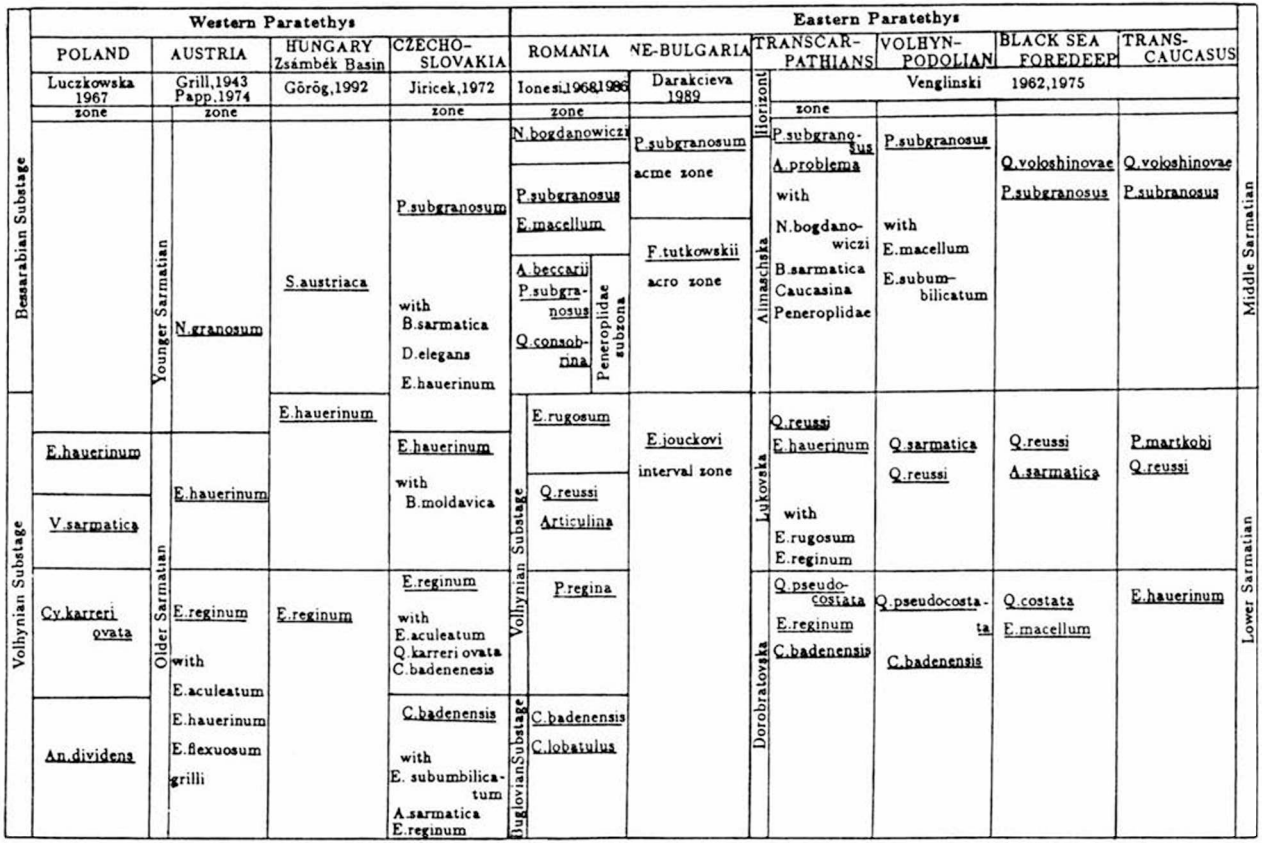


Table 1. Biostratigraphic correlation of the Sarmatian sediments in Paratethys. An. - Anomalinoides; A. - Articulina; B. - Bolivina; C. - Cibicides; Cy. - Cycloforina; D. - Dendritina; E. - Elphidium; F. - Flintina; N. - Nonion; Pa. - Parrelina (= Elphidium); P. - Porosononion; Q. - Quinqueloculina; S. - Spirolina; V. - Varidentella.

lower substage dissapeared and the species of the upper substage appeared in great numbers.

BOHN-HAVAS (1983) distinguished three characteristic mollusc assemblages in the Zsámbék Basin, but neither of their boundaries coincided with the Kozárd-Tinnye boundary. She proved the presence of the lower part of the Bessarabian Substage and the similarity of mollusca fauna with the different parts of the Eastern Paratethys.

The first foraminiferal zonation was made by GRILL (1943) and PAPP (1956) in the Vienna Basin, distinguishing the *Elphidium reginum* zone, *Elphidium hauerinum* zone and *Nonion granosum* zone, moreover correlating with the mollusc zones. In the Eastern Paratethys VENGLINSKI (1958-1974) established many foraminiferal zones and their connections with the mollusc zones, futhermore distinguished, on the basis of foraminifera, the Dorobratovska, the Lukovska and the Almaschska Horizons in Transcarpathians. In the last twenty years many biostratigraphic divisions were published from the different parts of the Paratethys. A summary of the foraminiferal zonations are presented on *Table 1.*

The Sarmatian foraminifera fauna of Hungary were investigated by some Hungarian paleontologists (SCHRÉTER, 1912, 1941; MAJZON, 1939, 1945; KÓKAY, 1954, BODA, 1959) but usually they published only a fauna list, without descriptions and illustrations. BODA (1971, 1974) found, in connection with the foraminifera fauna, that *Elphidium reginum* D'ORBIGNY, *Elphidium fichtelianum* D'ORBIGNY and *Cibicides lobatulus* WALKER & JAKOB are present only in the Kozárd Substage and *Elphidium aculeatum* D'ORBIGNY occured in great numbers during this time. In the Tinnye Substage *Porosononion granosum* D'ORBIGNY is very abundant and *Spirolina austriaca* D'ORBIGNY occurs only in this level. He correlated the substages with the mollusc and foraminifera zones of the Vienna Basin (GRILL, 1943; PAPP, 1956) and with the Substages of Eastern Paratethys. He established that the Kozárd Substage corresponds to the *Elphidium reginum* zone and the Volhynian Substage while the Tinnye Substage corresponds to the *Elphidium hauerinum* and the *Porosononion granosum* zones of the Vienna Basin and to the lower part of the Bessarabian Substage.

KORECZ-LAKY (1964-82) studied the Hungarian Sarmatian foraminifera fauna in detail, especially in the Mecsek and Tokaj Mountains, regarding the fauna of these areas as Lower Sarmatian *(Fig. 1).* She distinguished several foraminiferal biofacies (with Miliolidae, *Cibicides, Nodophthalmidium, Rotalia beccarii, Nonion granosum,* Elphididae and *Ammomarginulina-Miliammina*). Moreover she established that these biofacies are connected more with the lithological features than with the age, and a tendency can be ovserved that the Miliolidae biofacies appears in the lower, the *Nodophthalmidium* in the middle and the *Nonion granosum* biofacies in the upper part of the Hungarian Sarmatian formations.

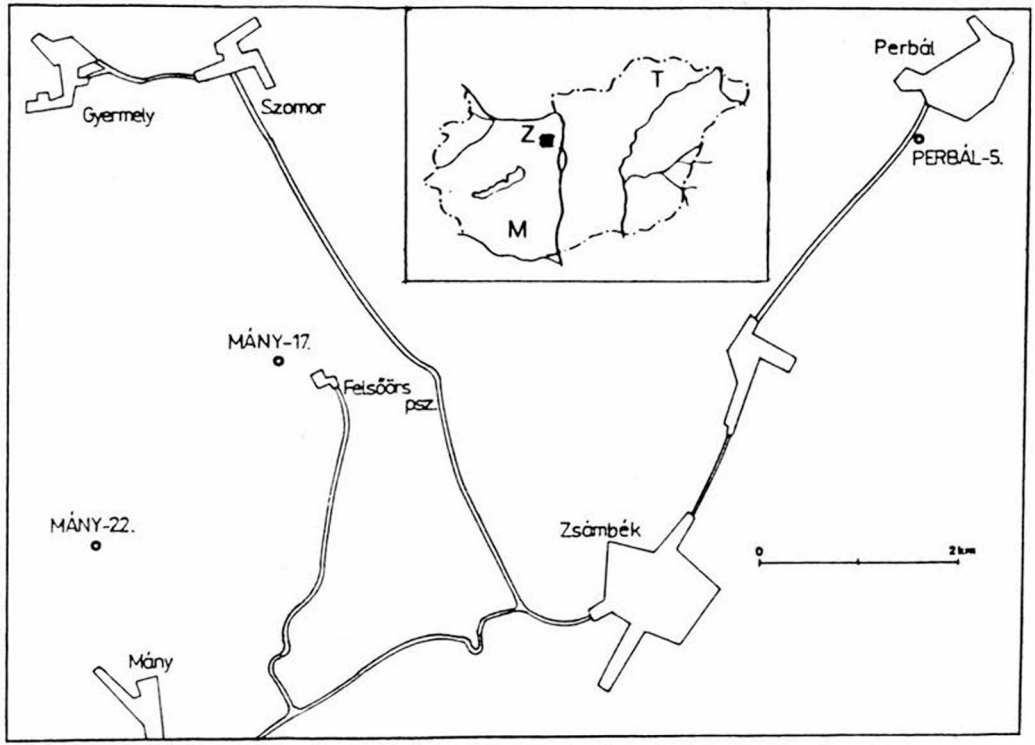


Fig. 1. Chart showing the locations of the studied boreholes. M – Mecsek Mts.; T – Tokaj Mts.; Z – Zsámbék Basin.

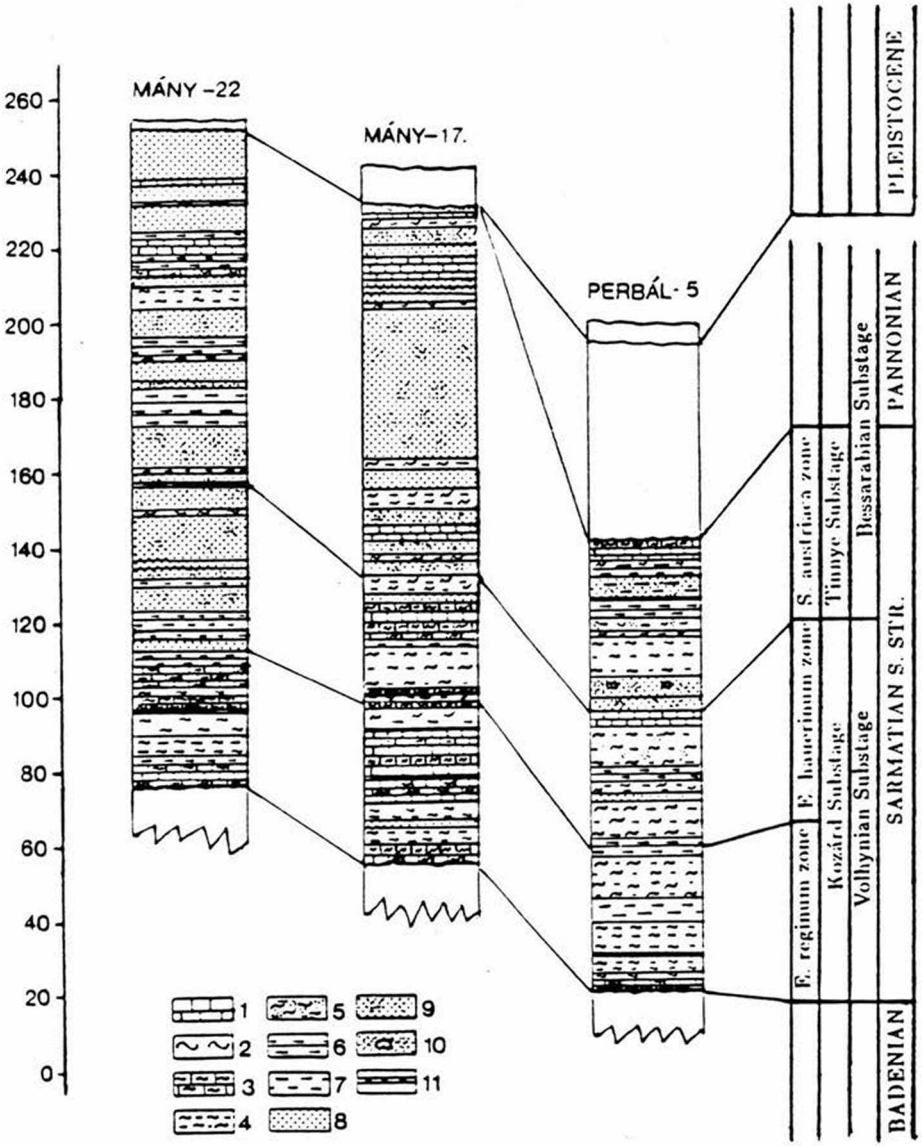


Fig. 2. Comparative profiles of the boreholes with lithological development and stratigraphic subdivision. Depths refer to the sealevel. 1 – limestone; 2 – marl; 3 – calcareous marl; 4 – clay-marl; 5 – silty clay-marl; 6 – aleurit; 7 – clay; 8 – sandstone; 9 – sand; 10 – calcareous sand; 11 – tuff.

The aim of the present paper was to give a study of the foraminifera fauna from the Zsámbák Basin, which is the type area of the Tinnye Substage and where a complete Sarmatian sequence can be found in boreholes. The Sarmatian foraminifera assemblage in this region have not been investigated in detail yet. The author established a stratigraphic zonation on the basis of foraminifera fauna and compared it with the mollusc zonation. The zones could be correlated with the other foraminifera based biostratigraphic units of the Paratethys.

Material and Methods

The material comes from three boreholes of the Zsámbék Basin, Mány-22, Mány-17 and Perbál-5, locality of them can be seen on the map *(Fig. 1)*. Drillings penetrated a Sarmatian succession, complete in the Hungarian sense. The Sarmatian formations are underlain by Badenian ones, with an unconform contact, but the sediment hiatus probably is not significant. Under and above the boundary the lithofacies is the same, but biofacies change is sharp, only a few Badenian species persisted into the Sarmatian, the number of the species strongly decreased. Lithology is varied, in the lower part of the Sarmatian series contains dominantly clay-marl, clay and marl. Often within the variegated layers narrow bentonit and dacit tuff intercalations from several centimeters to half meter can be observed. Above it, in the upper part mostly sand or sandstone alternates with ooid-limestone. The Sarmatian sediments are overlain in the Mány-22 and the Mány-17 boreholes by Pleistocene, while in the Perbál-5 boreholes with Lower Pannonian deposits *(Fig. 2)*.

The study is based on 122 samples of the three boreholes, which contain determinable foraminifera fauna. Foraminifera were separated by the author following the usual method for fossil foraminifera. More than 26000 specimens of 63 species were determined. As previously only 18 species were described and figured from the Hungarian Sarmatian formations, the author tought the detailed, modern descriptions are necessary. The synonym lists and the correlations of foraminifera faunas of the different parts of the Paratethys are based only on such publications, which contain figures and/or detailed descriptions of the species. The correlations of the three boreholes and the distinguishing of the foraminiferal zones are based on the distribution and abundance of the species. The abundance was studied both as percentage of the total foraminiferal assemblage and the number of their specimens in 100 g rocks. The distributions of the most important taxons are illustrated on diagrams. On the horizontal axis the dotted line shows that in the given depth no or undeterminable foraminifera were found. The boundries of the foraminiferal zones are marked by dashed lines.

The photos were made by the author with scanning electron microscope.

Stratigraphy

On the basis of the distribution of foraminifera species, inspite of the different lithological features, the three studied boreholes of the Zsámbék Basin, can be well correlated. Three zones could be distinguished in each boreholes. These are the follows: *Elphidium reginum* zone, *Elphidium hauerinum* zone and *Spirolina austriaca* zone. Their positions in the boreholes can be seen on *Fig. 2* and on the diagrams *(Fig. 3-13)*. Stratigraphic range of the species is shown on *Table 2.*

Elphidium reginum zone

This zone is based on *Elphidium reginum* (D'ORBIGNY) taxon-range zone *(fig. 3)*. In the Mány-17. and Mány-22. boreholes this species occurs, similarly to the Vienna Basin (PAPP, 1956), only in the *Elphidium reginum* zone, while in the Perbál-5. borehole it appeared in the lowermost part of the *Elphidium hauerinum* zone too. In the Transcarpathians this species can be found both in the Dorobratovska and the Lukovska Horizon *(Table 1, 2)*. This species is also mentioned from the Middle Sarmatian of the Eastern Paratethys (VENGLINSKI, 1975; DIDKOWSKI & SATANOVSKAJA, 1970).

Elphidiidae species are very frequent in the sections *(Fig. 4)*. The abundance of the "large" elphidiids (*E. fichtelianum* (D'ORBIGNY), *E. aculeatum* (D'ORBIGNY) and *E. reginum* (D'ORBIGNY) is characteristic of this zone *(Fig. 5)*.

In the lowermost layers of the Sarmatian formations besides the elphidiids Hauerinidae appeared in great numbers, but only a few species are represented, namely *Cycloforina badenensis* (D'ORBIGNY), *Cycloforina toreuma* (SEROVA), *Pseudotriloculina consobrina* (D'ORBIGNY) and *Varidentella rotunda* (GERKE) *(Fig. 6)*. These layers corresponds to Miliolidea biofacies of KORECZ-LAKY, and resemble foraminifera associations described from Poland (LUCZKOWSKA, 1974) and Romania (DARAKCIEVA, 1989). Above, until the upper part of this zone the amount of Hauerinidae is subordinate.

Cibicides lobatulus WALKER & JAKOB is one of the typical species of *Elphidium reginum* zone. It can be found in the upper part of the sections, but its mass occurrence is here (Fig. 8). In some area of the Paratethys *Cibicides* and *Anomalinoides* sp. are used as zone marker species in the Lower Sarmatian (VENGLINSKI, 1962; SENEŠ, 1972; JIRICEK, 1972; LUCZKOWSKA, 1974; VASS et al., 1974; IONESI, 1986) *(Table 1)*.

In the upper part of this zone numerous new hauerinids occur. Some of them is confined only to this short interval and vanished at the end of this zone (e. g. *Nodobaculariella ovalis* VENGLINSKI, *Quinqueloculina buchiana* D'ORBIGNY and a new agglutinated form, *Siphonaperta longidentata* n. sp.),

SPECIES	FORAMINIFERAL ZONES			1		2	3		4		5		6			
	E.reginum	E.hauerinum	S.austriaca	B	S	S	B	LS	B	S	LS	MS	B	D	L	A
Spiroloculina okrojantzi BOGDANOWICH	–					+					+			+	+	+
Nodophthalmidium aff. prima (BOGDANOWICH)	–															+
Nodophtalpmidium asperum n.sp.	–															
Nodophthalmidium rugosum n. sp.	–		–													
Nodobacullariella didkowskii BOGDANOWICH	–	–											+	+		
Nodobacullariella ovalis VENGLINSKI	–									+				+	+	
Nodobacullariella sulcata (REUSS)	–	–				+	+			+				+	+	
Schlumbergerina fabularoides (KARRER)			–				+									
Siphonaperta longidentata n. sp.	–															
Cycloforina badenensis d'ORBIGNY	–	–	–	+			+	+	+	+			+			
Cycloforina contorta (d'ORBIGNY)		–	–	+			+	+	+	+			+			
Cycloforina fluviata (VENGLINSKI)		–	–								+			+	+	+
Cycloforina predkarpatica (SEROVA)		–	–					+						+		
Cycloforina stomata LUCZKOWSKA			–					+								
Cycloforina toreuma (SEROVA)	–							+					+			
Cycloforina vermicularis (KARRER)	–	–	–				+									
Hauerina irschavensis VENGLINSKI & BURIN.			–											+	+	+
Hauerina podolica SEROVA			–				+				+		+			
Quinqueloculina anagallis LUCZKOWSKA			–				+									
Quinqueloculina buchiana d'ORBIGNY		–	–	+			+	+					+			
Affinetrina cubanica (BOGDANOWICH)		–	–				+	+						+	+	+
Affinetrina ucrainica (SEROVA)		–	–				+				+	+	+			+
Miliolinella banatiana LUCZKOWSKA			–				+									
Miliolinella selene (KARRER)			–									+				
Pseudotriloculina consobrina (d'ORBIGNY)	–	–	–	+	+		+	+	+	+			+	+	+	+
Pseudotriloculina inflata (d'ORBIGNY)			–	+			+	+					+			+
Triloculina gibba d'ORBIGNY			–	+			+	+					+	+		
Triloculina intermedia KARRER	–		–				+						+	+	+	
Varidentella latelacunata (VENGLINSKI)		–	–					+			+			+	+	
Varidentella pseudocostata (VENGLINSKI)		–	–					+						+	+	
Varidentella reussi (BOGDANOWICH)		–	–			+		+		+	+			+	+	+
Varidentella rotunda (GERKE)	–	–	–			+	+	+					+	+	+	

Table 2. Stratigraphic range of the Sarmatian foraminifera in the Zsámbék Basin and in Paratethys. The foraminiferal zones refer to the Zsámbék Basin. WESTERN PARATETHYS: 1 - Austria, Vienna Basin (D'ORBIGNY, 1846, KARRER, MARKS, 1951, PAPP, 1963, PAPP at SCHMID, 1985); 2 - Czecho-slovakia (Est-Carpathians) (BRESTENSKÁ 1974, CICHA et ZAPLETALOVÁ, 1961); 3 - Poland (LUCZKOWSKA, 1974).

SPECIES	FORAMINIFERAL ZONES			1		2	3		4		5		6			
	E.reginum	E.hauerinum	E.austriaca	B	S	S	B	LS	B	S	LS	MS	B	D	L	A
Articularia articulinoides (GERKE & ISSAEVA)			—					+			+			+	+	
Articulina aff. nitida d'ORBIGNY	—									+			+			
Articulina problema BOGDANOWICH	—	—	—				+	+			+	+		+	+	+
Spirolina austriaca d'ORBIGNY			—	+					+				+			+
Guttulina communis d'ORBIGNY		—		+					+				+			
Oolina mironovi (BOGDANOWICH)		—											+			
Bolivina antiqua d'ORBIGNY		—		+					+				+	+	+	
Bolivina moldavica DIDKOWSKI	—	—	—			+										+
Bolivina moravica CICHA & ZAPLETALOVA	—	—	—		+	+							+			
Bolivina sagittula DIDKOWSKI		—	—			+										+
Bolivina sarmatica DIDKOWSKI	—	—	—			+										+
Cassidulina margareta KARRER	—	—	—	+									+	+	+	+
Bulimina elongata d'ORBIGNY	—	—	—	+					+				+	+	+	+
Buliminella elegantissima (d'ORBIGNY)	—	—	—													+
Fursenkoina acuta (d'ORBIGNY)	—	—	—	+					+				+			
Caucasina schischkinskye (SAMOYLOVA)	—	—	—										+	+	+	+
Rosalina obtusa d'ORBIGNY	—	—	—	+	+				+				+	+	+	
Schackoinella imperatoria (d'ORBIGNY)	—	—	—		+			+		+			+	+	+	
Cibicides lobatulus (WALKER & JACOB)	—	—	—	+	+	+			+	+			+	+	+	
Nonion bogdanowiczi VOLOSHINOVA	—	—	—			+				+	+	+	+	+	+	+
Porosononion granosum (d'ORBIGNY)	—	—	—	+	+	+				+	+	+		+	+	+
Aubignyna simplex (d'ORBIGNY)	—	—	—										+	+	+	+
Ammonia beccarii (LINNE')	—	—	—	+	+	+			+	+			+	+	+	+
Elphidium aculeatum (d'ORBIGNY)	—	—	—		+	+				+	+			+	+	+
Elphidium crispum (LINNE')	—	—	—	+	+				+	+	+	+	+	+	+	+
Elphidium fichtelianum (d'ORBIGNY)	—	—	—	+	+	+				+	+		+	+	+	+
Elphidium flexuosum reussi MARKS	—	—	—	+		+										
Elphidium hauerinum (d'ORBIGNY)	—	—	—		+	+				+	+	+	+	+	+	+
Elphidium macellum (FICHTEL & MOLL)	—	—	—			+			+	+	+	+	+	+	+	+
Elphidium obtusum (d'ORBIGNY)	—	—	—	+	+						+					
Elphidium reginum (d'ORBIGNY)	—	—	—		+	+				+	+			+	+	

4 - Hungary, except the Zsámbék Basin (KORECZ-LAKY, 1964, 1965, 1968, 1973, 1982); EASTERN PARATETHYS: 5 - North-western Bulgaria (STANCHEVA, 1960); 6 - Transcarpathians and Volhyn-Podolian Platform (VENGLINSKI, 1958, 1962, 1975, DIDKOWSKI et SATANAOVSKAJA, 1970); B - Badenian; S - Sarmatian; LS - Lower Sarmatian; MS - Middle Sarmatian; D - Dorobratovska Horizon; L - Lukovska Horizon; A - Almaschska Horizon.

while the others persist into the next zone (e. g. *Varidentella pseudocostata* (VENGLINSKI)) or even higher (e. g. *Cycloforina fluviata* (VENGLINSKI)). There are some, which dissapear at the boundary and appear again in the upper zone (e. g. *Triloculina gibba* D'ORBIGNY) *(Table 2)*.

The upper part of this zone is characterized by the appearance of Miliolina with uniserial part, like *Articulina* aff. *nitida* D'ORBIGNY, *Articulina problema* BOGDANOWICH, *Nodophthalmidium* aff. *prima* (BOGDANOWICH), *N. asperum* n. sp. and *N. rugosum* n. sp. in relatively great numbers *(Fig. 7)*. Making use of the large test size (up to a few mm), this faunal assemblage can already be recognized on the fields. The occurrance of these species strongly depends on the quality of the deposits, favours the fine-grained sediments and quiet depositional environment. This foraminifera community corresponds to the *Nodophthalmidium* biofacies of KORECZ-LAKY (1964-82). In the Paratethys, from the Vienna Basin to Caucasus, this biofacies is especially widespread in the Lower Sarmatian (KORECZ-LAKY, 1973). This characteristic association occurs in the Middle Sarmatian too, e. g. in Bulgaria (STANCHEVA, 1960; DARAKCIEVA, 1989) and Transcarpathians (VENGLINSKI, 1962) (Table 1).

Ammonia beccarii (LINNÉ) is more frequent in this zone than above, but probably the abundance of it strongly depends on the ecological factors *(Fig. 9)*.

This zone corresponds to the *Elphidiuim reginum* zone of the Vienna Basin (PAPP, 1963) and could be correlated with the Dorobratovska Horizon (VENGLINSKI, 1958) in Transcarpathians *(Table 1)*.

The *Elphidium reginum* zone can be found in the Mány-22. borehole between 179.1-141.3 m, in the Mány 17. borehole between 185.6-144.1 m and in the Perbál-5. borehole between 178.4-141.1 m.

Elphidium hauerinum zone

This zone is based on the *Elphidium hauerinum* (D'ORBIGNY) abundance-zone *(Fig. 10)*. The boundary between the *Elphidium reginum* zone and *Elphidium hauerinum* zone is defined by the first mass occurrance of *Elphidiium hauerinum*. This species also occurs below and above this zone, but not in such great numbers and it is not so characteristic element of the fauna as here.

At the boundary (in Mány-22 and Mány-17 boreholes) or somewhat higher (in Perbál-5 borehole, above with 0.4 m) *Elphidium reginum* vanished completely *(Fig. 3)*.

In the bottom layers (except the Perbál-5. borehole) Bolivinidae abruptly became very frequent *(Fig. 11)*. Similar situation can be observed in Mány-17. borehole at the upper boundary of this zone. It is characterized with the predominance of *Bolivina moldavica* DIDKOWSKI, representing more than 80%

of bolivinids. Moreover the next Bolivina species came to daylight from this layers: *B. antiqua* D'ORBIGNY, *B. moravica* CICHA & ZAPLETALOVÁ. Besides the bolivinids *Bulimina elongata* D'ORBIGNY, *Buliminella elegantissima* (D'ORBIGNY), *Caucasina schischkinskye* (SAMOYLOVA) and *Rosalina obtusa* D'ORBIGNY are comparatively abundant here.

This predominance of *Elphidium hauerinum* (D'ORBIGNY) and *Bolivina moldavica* DIDKOWSKI in the foraminifera fauna was also found by JIRICEK (1972) during the *Elphidium hauerinum* zone in Pannonian Basin, in Czecho-Slovakia (PAPP & SEÑEŠ, 1974).

The amount of the Hauerinidae, except in the lowermost and the uppermost layers of the zone is subordinate, the number of the species and their amount is considerably decreased in comparison with the boundary of the *Elphidium reginum* and *Elphidium hauerinum* zone (Fig. 6). The characteristic hauerinids of this zone are *Cycloforina badenensis* (D'ORBIGNY), *Pseudotriloculina consobrina* (D'ORBIGNY), *Varidentella latelacunata* (VENGLINSKI), *V. pseudocostata* (VENGLINSKI) and *V. rotunda* (GERKE).

30-40 m above the lower boundary numeruos species, which come from the Badenian or characterize the *Elphidium reginum* zone, vanished completely – namely *Nodobacullariella didkowskii* BOGDANOWICH, *Nodobacullariella sulcata* (REUSS), *Guttulina communis* D'ORBIGNY, *Oolina mironovi* (BOGDANOWICH), *Bolivina antiqua* D'ORBIGNY, *Buliminella elegantissima* (D'ORBIGNY) and *Elphidium fichtelianum* (D'ORBIGNY) – or their amount significantly decrease e. g. *Elphidium aculeatum* (D'ORBIGNY), *Elphidium hauerinum* (D'ORBIGNY), *Elphidium flexuosum reussi* MARKS and *Elphidium obtusum* (D'ORBIGNY) *(Fig. 5).* Author recognized this level as the upper boundary of the *Elphidium hauerinum* zone.

The use of the *Elphidium hauerinum* zone is wide-spread in the biostratigraphy of Paratethys *(Table 2).* The low diversity and poor Miliolina assemblage of this zone in the Zsámbék Basin is similar to the other *Elphidium hauerinum* zones of the Western Paratethys (LUCZKOWSKA, 1974; PAPP, 1956), while in the Eastern Paratethys the fauna is more diversified and species of the Miliolina subordo are significant (VENGLINSKI, 1958, 1962; DARAKCIEVA, 1989).

This zone corresponds to the *Elphidium hauerinum* zone of the Vienna Basin (PAPP, 1956) and could be correlated with the Lukovska Horizon (VENGLINSKI, 1958) in Transcarpathians *(Table 1).*

The *Elphidium hauerinum* zone can be found in the Mány-22. borehole between 141.3-97.8 m, in the Mány-17. borehole between 144.1-111.6 m and in the Perbál-5. borehole between 141.1-104.8 m.

Spirolina austriaca zone

This zone is based on the *Spirolina austriaca* D'ORBIGNY acro zone, but the lower boundary was defined by the dissapearance of the typical species of the lower two zones (as mentioned above).

Spirolina austriaca D'ORBIGNY is the most characteristic species of this zone, it can be recognized easily even if the preservation is bad. Although it can also be found in Badenian formations, in the Sarmatian it was mentioned only above the *Elphidium hauerinum* zone in the Western Paratethys (BODA, 1971, 1974; JIRICEK, 1972; PAPP & SEÑES, 1974) and in the Middle Sarmatian of the Eastern Paratethys. In the latter area it was especially abundant and together with other *Spirolina, Dendritina* and *Peneroplis* species it often occured in masses (VENGLINSKI, 1962; DIDKOWSKI & SATANAOVSKAJA, 1970; IONESI, 1986). The first occurrence of *Spirolina austriaca* D'ORBIGNY coincides with the extinction boundary in the Mány-17. and the Perbál-5. boreholes, and 10 m higher in the Mány-22. borehole *(Fig. 12)*.

Hauerinidae became significant both in the number of species and the amount of specimens. *(Fig. 6)*. Some hauerinids occured only here (e. g. *Quinqueloculina anagallis* LUCZKOWSKA, *Miliolinella banatiana* LUCZKOWSKA, *Pseudotriloculina inflata* (D'ORBIGNY), *Triloculina gibba* (D'ORBIGNY) and on other part of them which disappeared at the end of the *Elphidium reginum* zone or at the lower part of the *Elphidium hauerinum* zone apperared again (e. g. *Affinetrina ucrainica* (SEROVA), *Affinetrina cubanica* (BOGDANOWICH) (see *Table 2*). Varidentella species are especially frequent, namely *Varidentella latelacunata* (VENGLINSKI) and *Varidentella rotunda* (GERKE).

The upper studied strata of the sections are characterized by the presence, in comparatively great numbers (more than 30 % of the total foraminifera assemblage), of species with termathophore aperture as *Hauerina irschavensis* VENGLINSKI et BURINDINA, *H. podolica* SEROVA and *Schlumbergerina fabularoides* (KARRER), which latter is finely agglutinated. Similar association can be found in the Almaschcka Horizon of Transcarpathians (VENGLINSKI, 1962, 1975; VENGLINSKI & BURINDINA, 1965)

In clay beds of this zone (especially in the Mány-22. borehole) *Articularia articulinoides* (GERKE et ISSAEVA) and *Articulina problema* BOGDANOWICH appeared in realtively great numbers *(Fig. 7)*.

Porosononion granosum (D'ORBIGNY) appears in great numbers in these parts of the sections, somewhat more abundant in this zone than in the lower ones, but the difference is not significant *(Fig. 13)*.

The elphidiidae assemblage is characterized by the predominance of *Elphidium macellum* (FICHTEL et MOLL) (see *Fig. 4, 5, 10* and *Table 2*).

Ammonia beccarii (LINNÉ) is abundant in several strata *(Fig. 9)*.

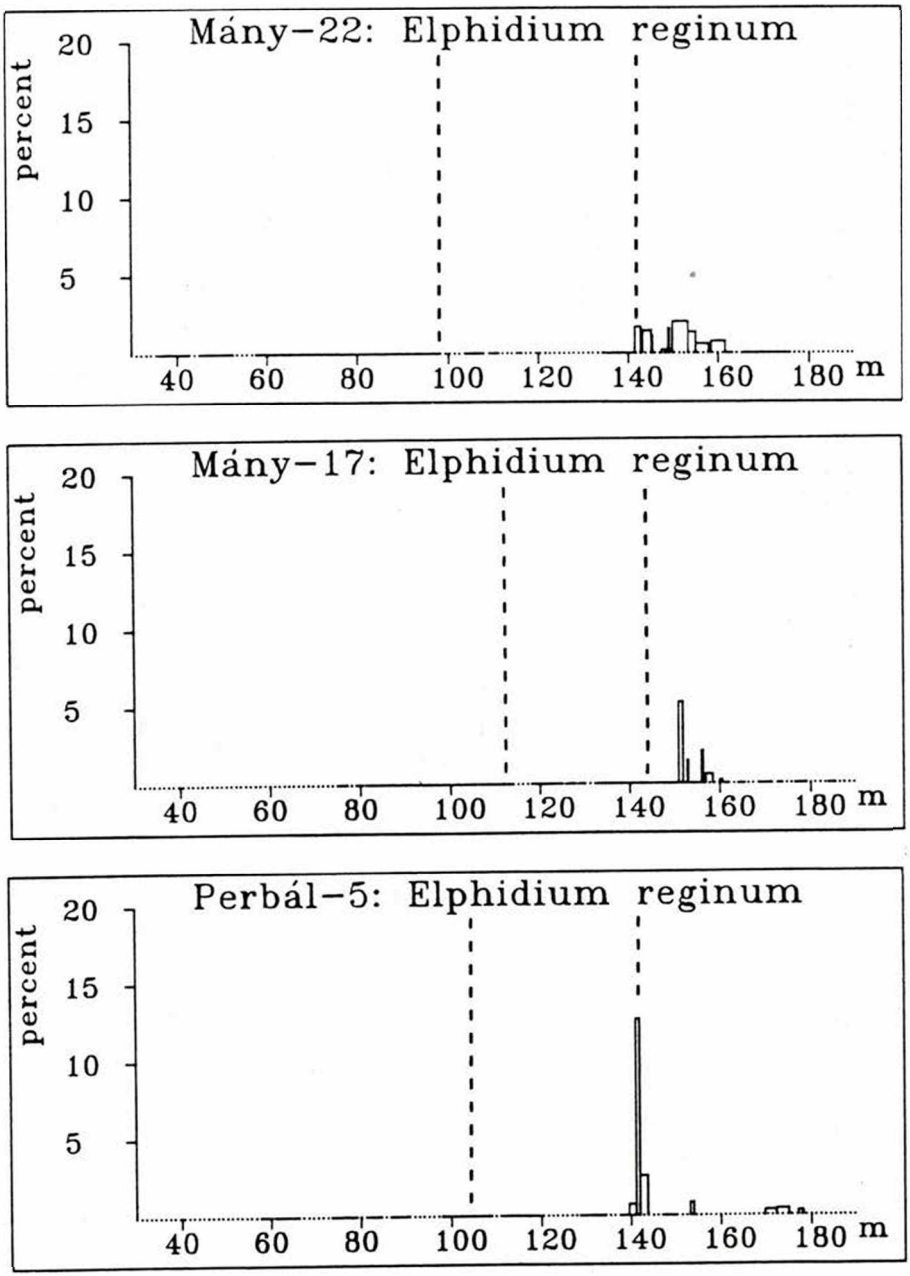


Fig. 3. Distribution of *Elphidium reginum* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

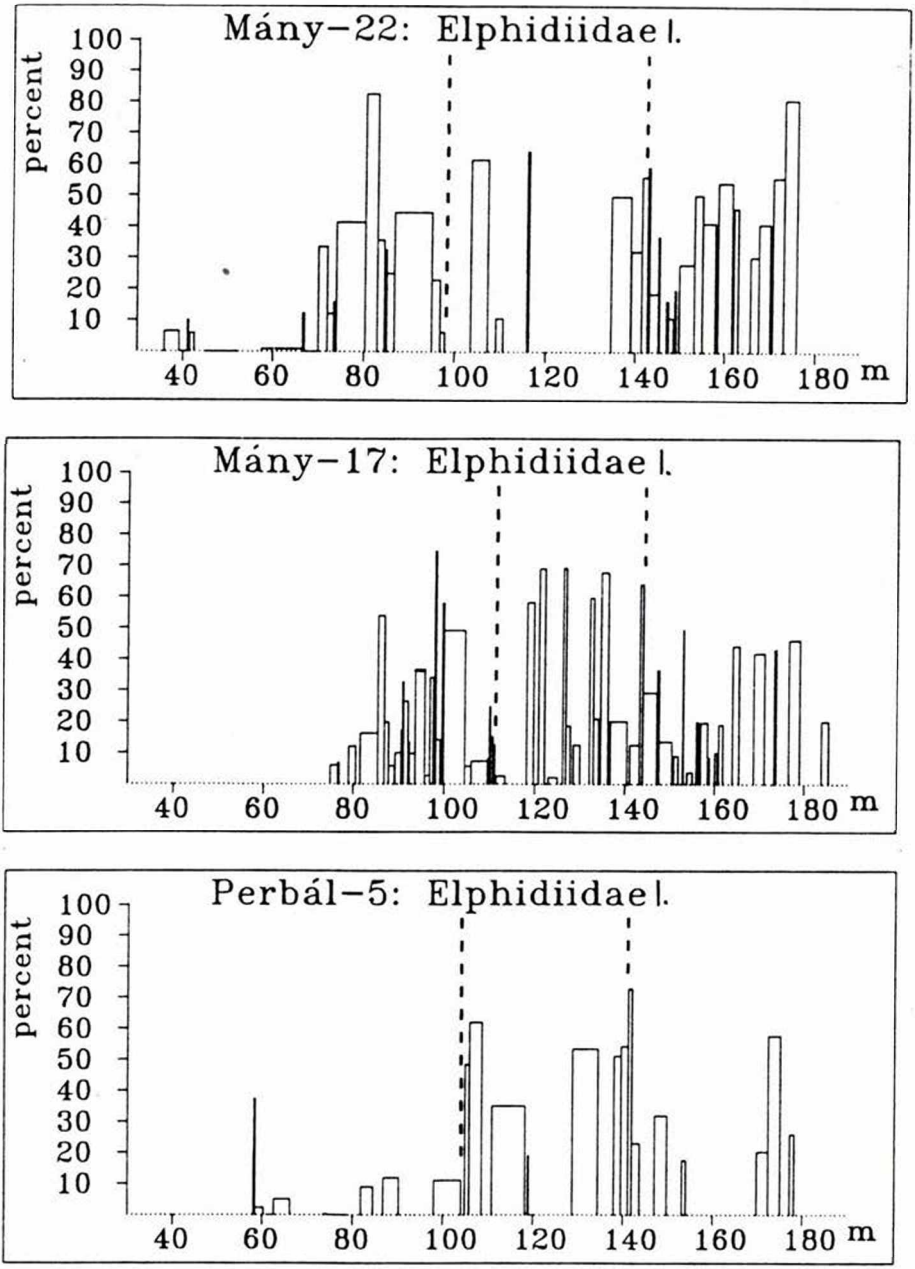


Fig. 4. Distribution of *Elphidiidae I E aculeatum, E. crispum, E fichtelianum, E. flexuosum reussi, E. hauerinum, E. macellum, E. obtusum* and *E. reginum* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

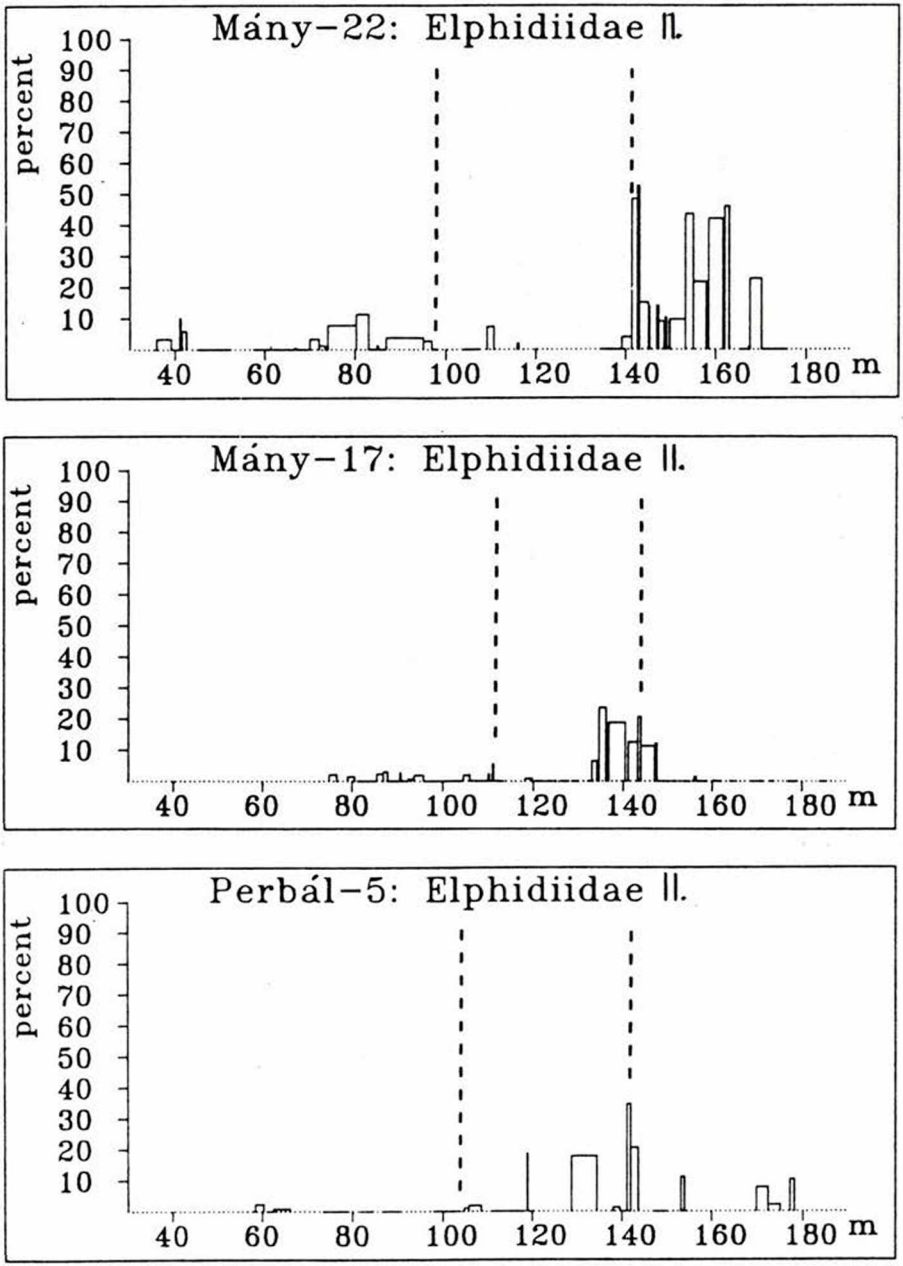


Fig. 5. Distribution of Elphidiidae II. *E. aculeatum*, *E. fichtelianum* and *E. flexuosum reussi* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

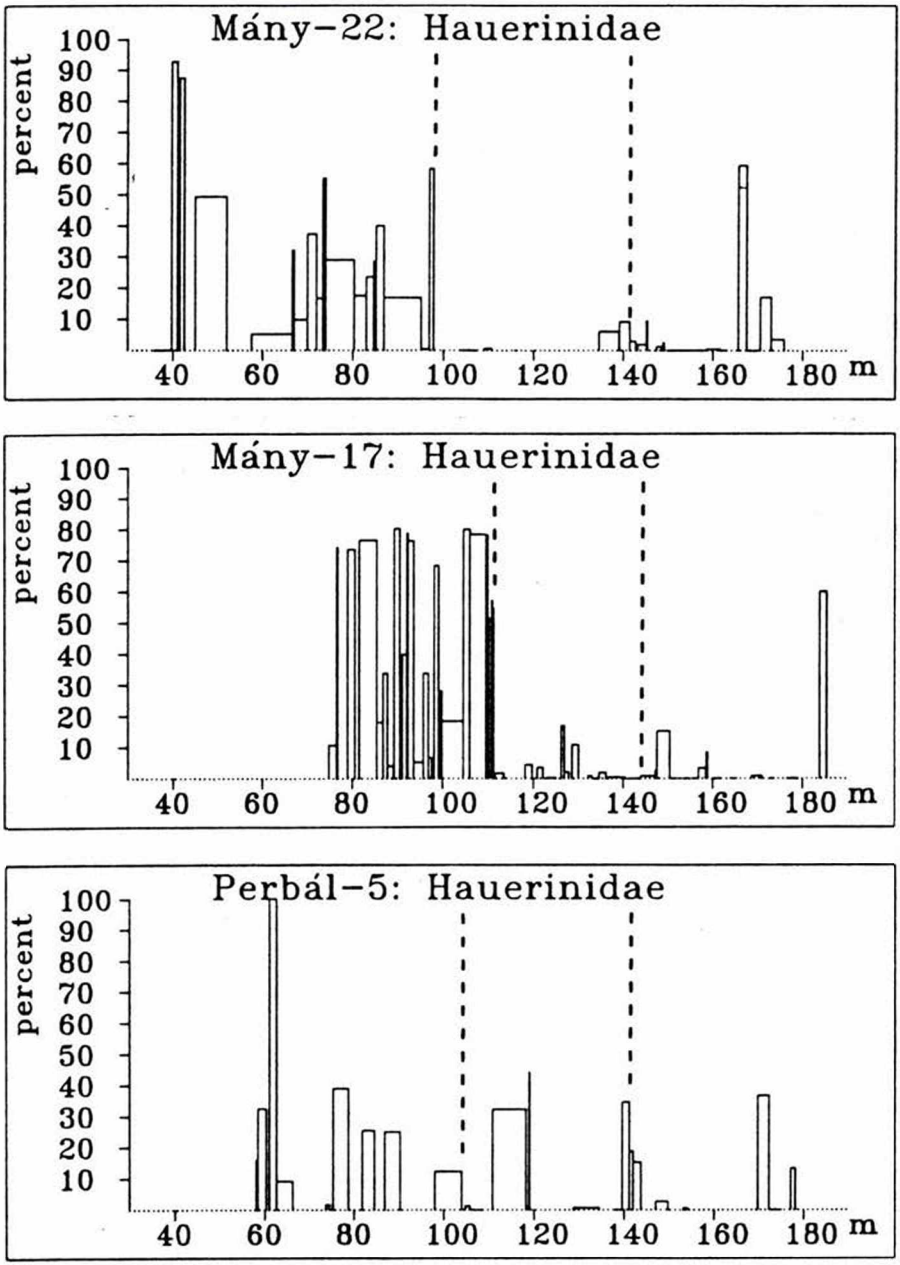


Fig. 6. Distribution of Hauerinidae *Schlumbergerina, Siphonaperta, Cycloforina, Hauerina, Quinqueloculina, Affinetrina, Miliolinella, Pseudotriloculina, Triloculina, Varidentella, Articularia* and *Articulina* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

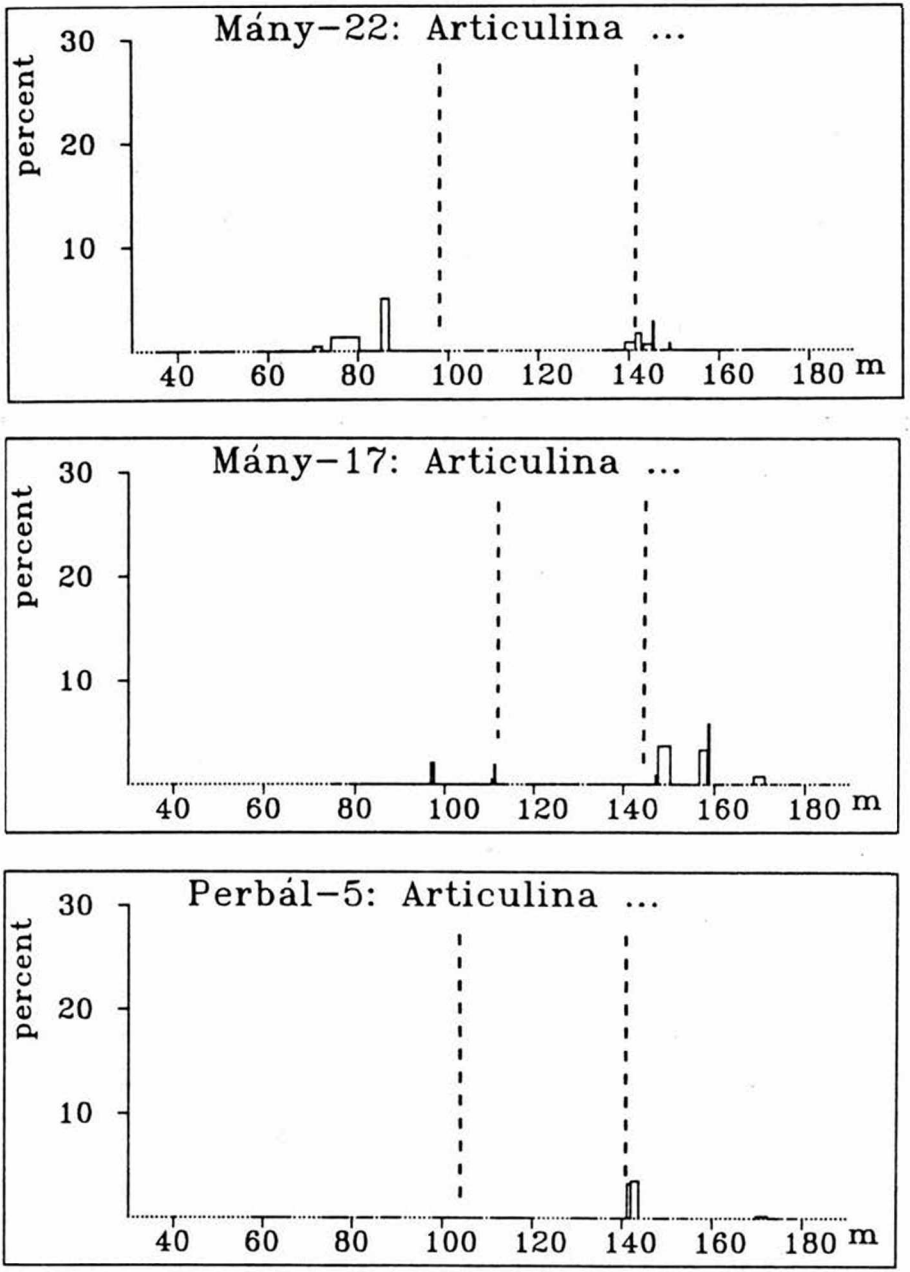


Fig. 7. Distribution of *Articulina*, *Articularia* and *Nodophthalmidium* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

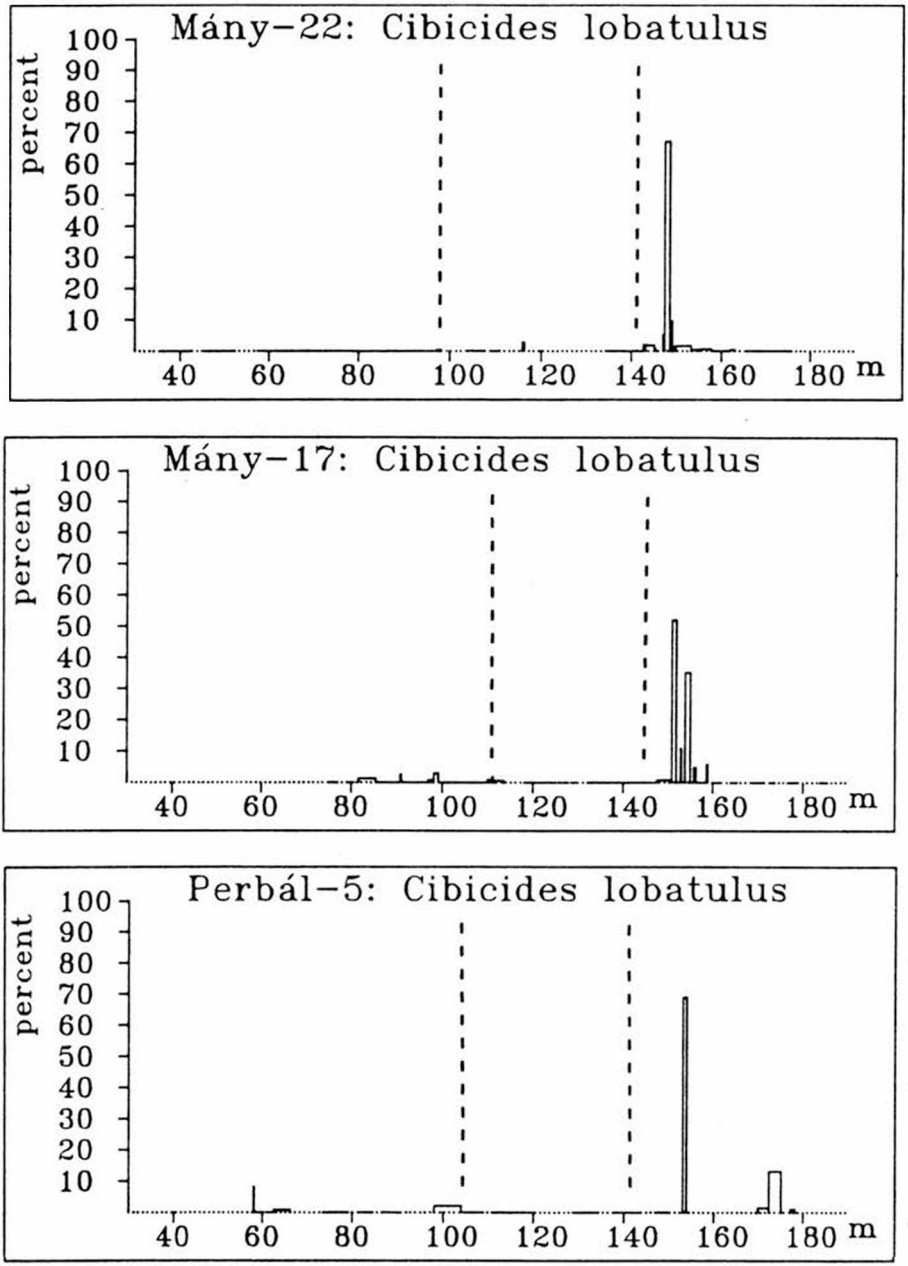


Fig. 8. Distribution of *Cibicides lobatulus* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

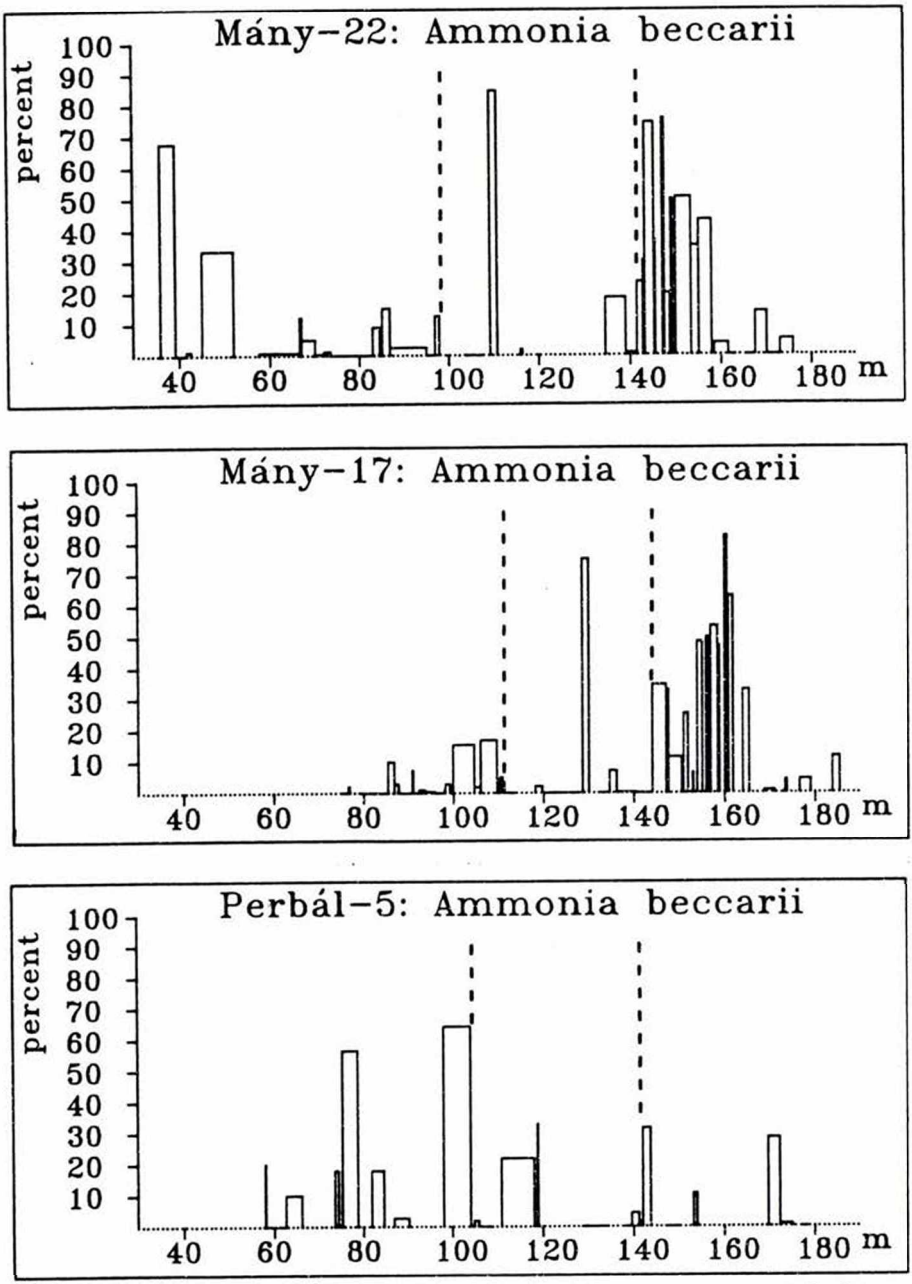


Fig. 9. Distribution of *Ammonia beccarii* inthe boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

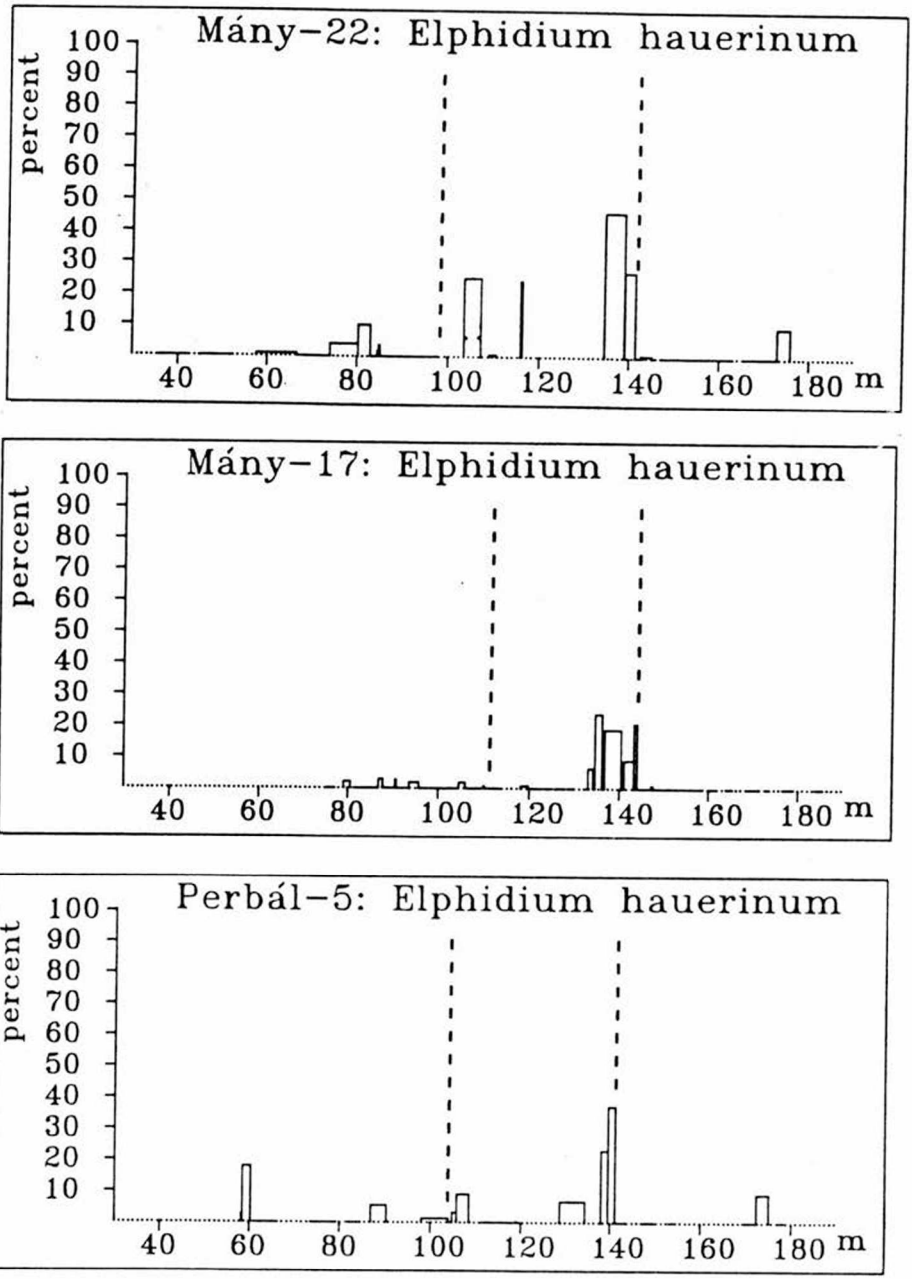


Fig. 10. Distribution of *Elphidium hauerinum* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

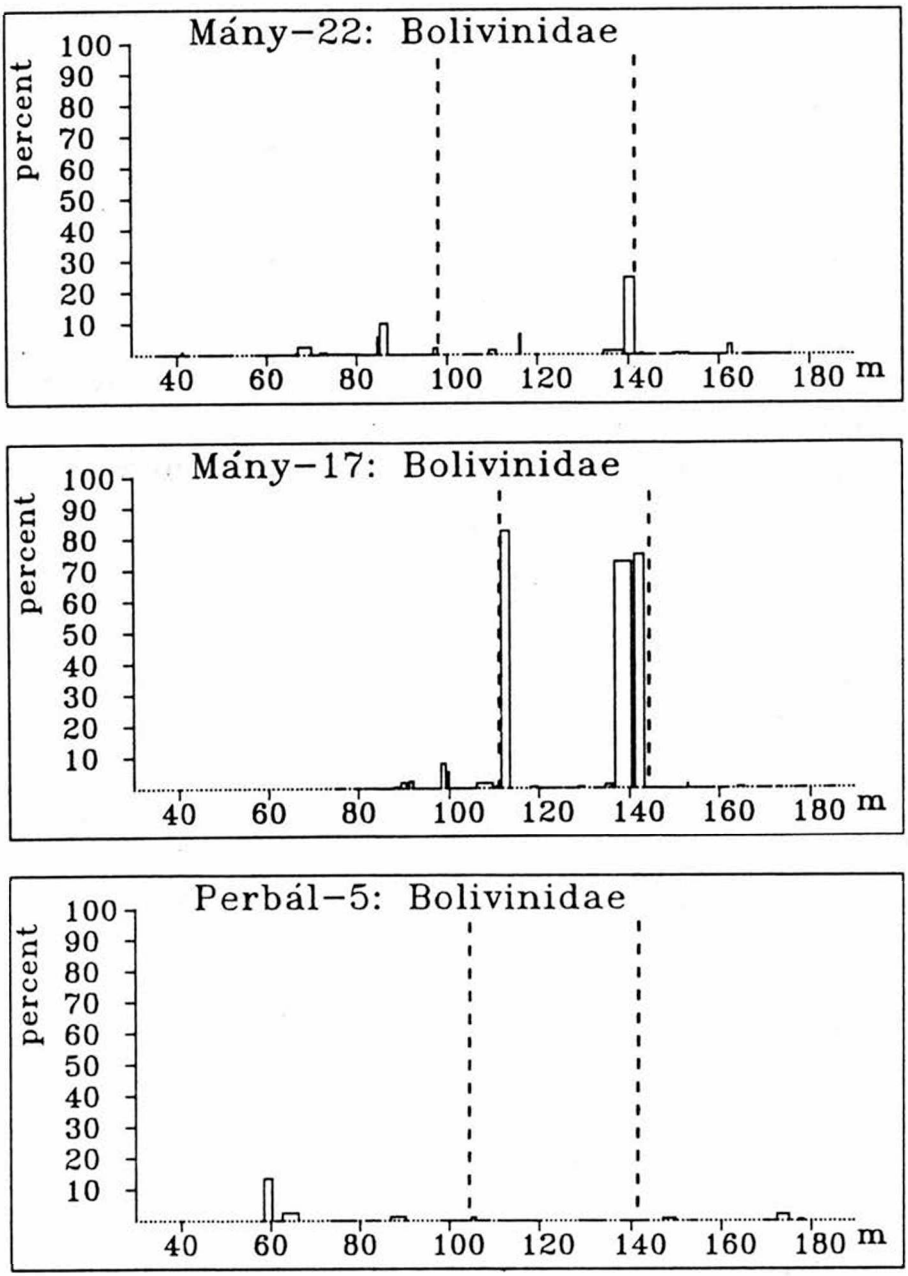
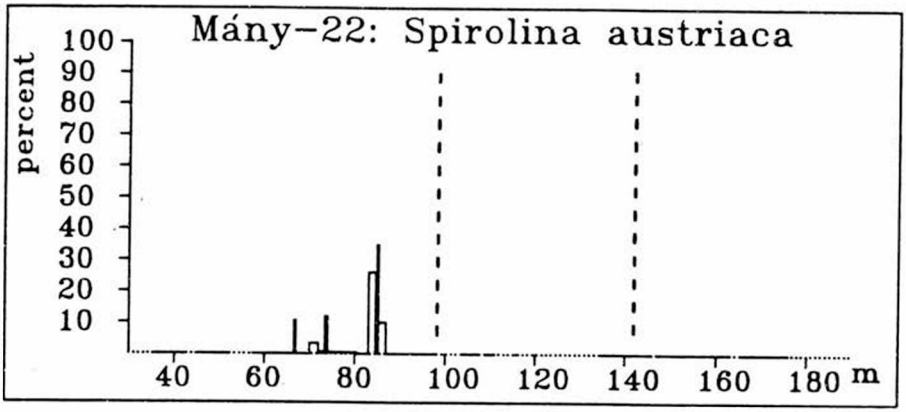
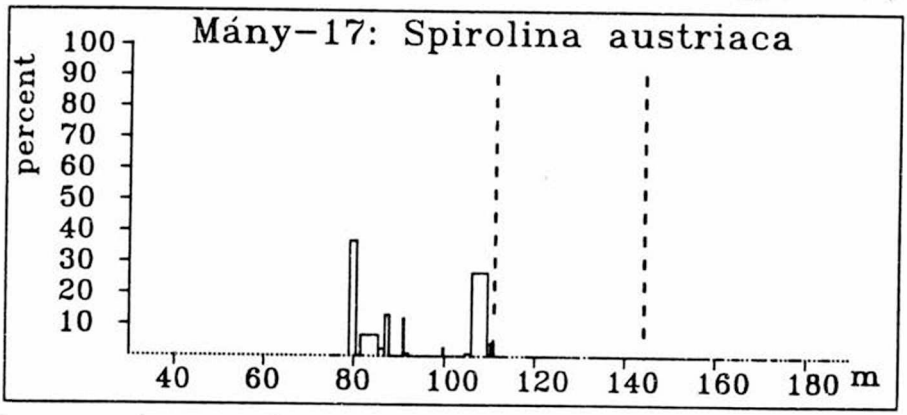


Fig. 11. Distribution of Bolivinidae *(Bolivina antiqua, B. moldavica, B. moravica* and *B. sagittula)* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.





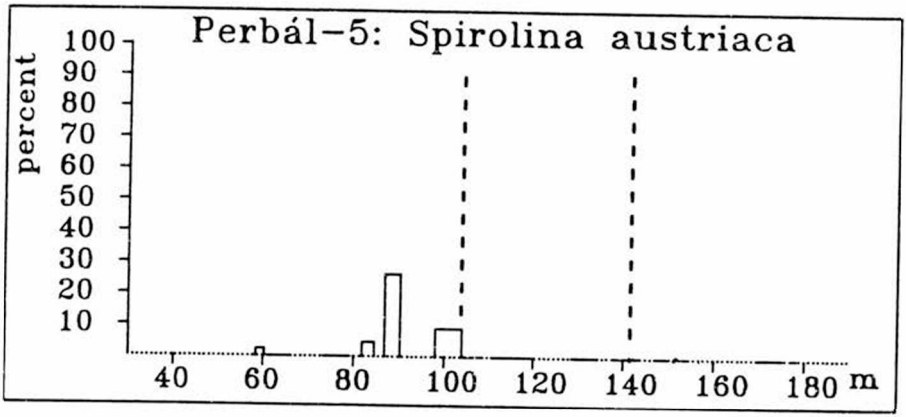


Fig. 12. Distribution of *Spirolina austriaca* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

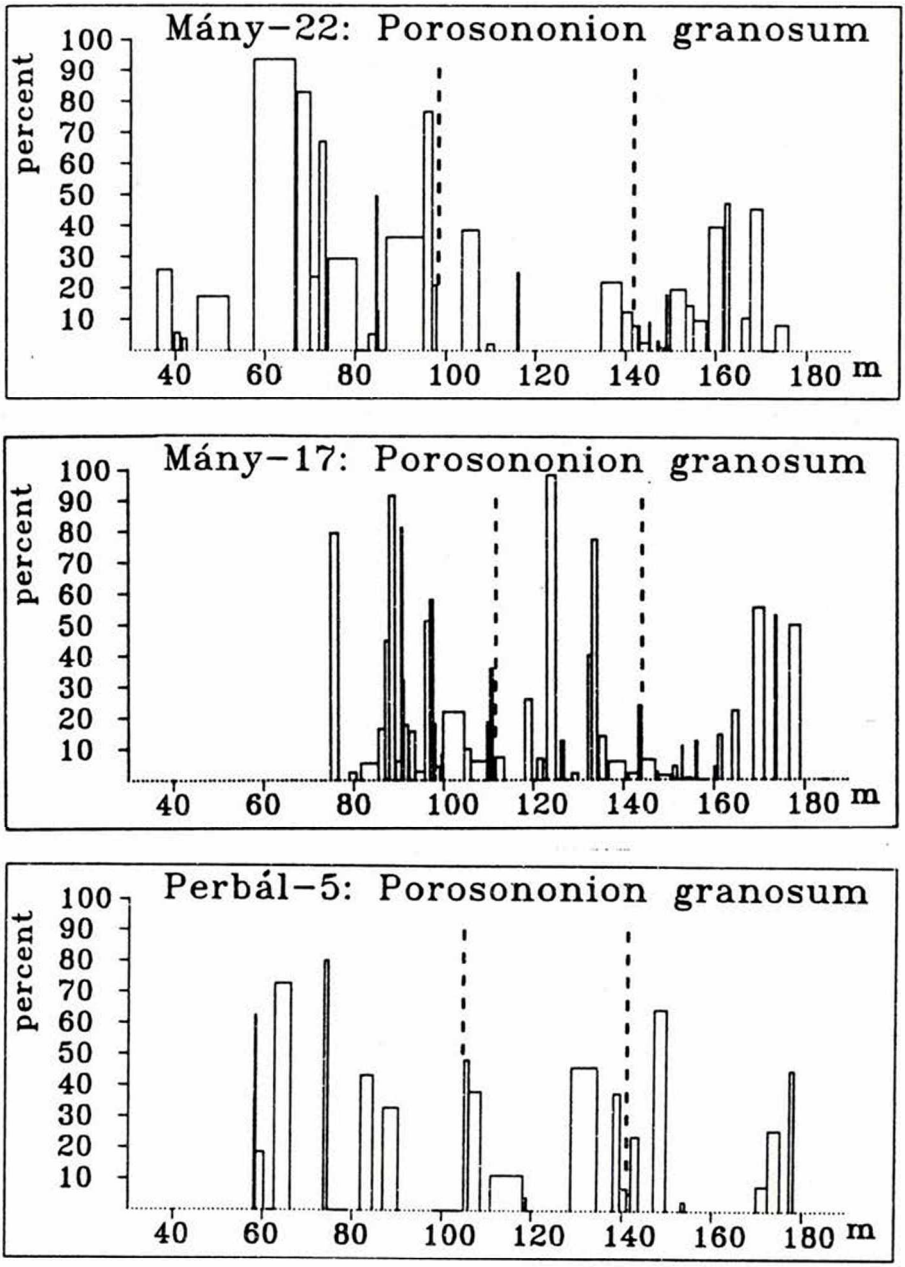


Fig. 13. Distribution of *Porosononion granosum* in the boreholes. Abundance is given as % of the total foraminiferal assemblage. Depths refer to the ground surface.

The *Porosononion (=Nonion= Protelphidium) granosum(=subgranosum)* zone is very much used – in abundance- zone sense – above the *Elphidium hauerinum* zone in the Paratethys *(Plate 1).* However this species can be observed in most numbers in the Lower Sarmatian of North-western Bulgaria, by STANCEVA (1960). In spite of the fact mentioned above the *Spirolina austriaca* zone can be correlated with the *Porosononion granosum* zone of Paratethys. The fauna assemblage – especially the great numbers of *Spirolina austriaca* D'ORBIGNY and the high diversity of Hauerinidae – of this zone in the Zsámbák Basin shows a closer connection with the foraminifera fauna of the Almaschka Horizon in Transcarpathians (VENGLINSKI, 1958) than with that of the *Porosononium granosum* zone in the Vienna Basin (PAPP, 1956, 63).

The *Spirolina austriaca* zone can be found in the Mány-22. borehole between 97.8-3.4 m, in the Mány-17. borehole between 111.6-10 m and in the Perbál-5. borehole between 104.8-58 m.

Paleoecology

In the studied boreholes of the Zsámbék Basin the Badenian-Sarmatian boundary was defined distinctly by an unconform contact between two isopic, shallow-marine basin litofacies and a sharp fauna change. Numeruos Badenian foraminifera vanished and the poor Sarmatian fauna appeared, indicating a decreasing of salinity. The appearence of Hauerinidae in relatively great numbers in the lowermost strata suggests shallow and probably warm water. Hauerinidae suffers the change of salinity, their occurrence depends on the depth and the temperature, as recently this group mainly lives in shallow-warm-water of the infralittoral zone (between 0-100 m) (LUCZKOWSKA, 1974; CHIERICHI et al., 1962). In these layers irregularly coiled or very low trochospiral specimens of *Ammonia beccarii* (LINNÉ) *(Pl. XI. fig. 3.)* can also be found together with " Siamise" twins specimens of *Porosononion granosum* (D'ORBIGNY), *Elphidium macellum* (FICHTEL & MOLL) *(Pl. XII. fig. 8)* and *Elphidium hauerinum* (D'ORBIGNY) *(Pl. XII. fig. 4-5).*

Above the hauerina-rich layers, a 20 or 25 m interval is characterized by an almost complete lack of Hauerinidae (Fig. 6) and the predominance of the "large" elphidiids *(Fig. 3, 5),* supposing a somewhat deeper and slightly colder water (GUDINA & LEVTCHUK, 1989). At about 150 m in each boreholes *Cibicides lobatulus* (WALKER & JAKOV) became very frequent, up to 70 percent of the total foraminifera assemblage, indicating a shallower environment, than earlier. *Cibicides lobatulus* prefers the shallow water, a depth of 40-70 m in Adriatic sea (CHIERICHI et al., 1962). In the uppermost strata of *Elphidium reginum* zone the foraminifera assemblage considerably changes, numerous new – mainly miliolinas (15) and only one *Cassidulina* – species

appeared. *Articulina* also occured here in great numbers for the first time. This species favours the very shallow-water, about a depth of 30 m (LUCZKOWSKA, 1974). The facts above indicate continued decreasing of the depth. The biofacies with *Cibicides* or *Anomalinoides* and the biofacies with *Articulina* and *Nodophthalmidium* are wide spread in the Lower Sarmatian, supposing similar, shallow marine paleoenvironmental parameters in the different parts of Paratethys.

In the present-day Zsámbék Basin in the *Elphidium reginum* zone the changes of foraminifera assemblages show a gradual change from not-too-deep to shallow water and less agitated environment with consolidated brackish-water condition with a salinity of about 18 to 25 per thousand.

Above the *Elphidium reginum* zone at the lower boundary of the *Elphidium hauerinum* zone no sharp litological change and sediment hiatus can be observed, but the change of the foraminifera assemblage is significant. The diversity of the fauna is substantially decreased, half of the species (20), which can be found in the upper part of the *Elphidium reginum* zone, vanished completely here or somewhat higher. Several among them appeared again in the uppermost strata of this zone (4 species) or in the *Spirolina austriaca* zone (7 species) *(Table 2)*. In this zone only a few species occured, but in great numbers. The fauna is characterized by the predominance of elphidiids and a poor miliolina assemblage. In the beds at the lower and the upper boundary of this zone, especially in the Mány-17. borehole, Bolivinidae, Buliminidae and Caucasinidae species appeared in masses. These groups favour the somewhat deeper water, Bolivinidae recently live below 100 m in the Adriatic Sea (PHLEGER, 1960; CHIERICI et al, 1962) and suffer a salinity of 18-28 per thousand (PHLEGER, 1960; CICHA & ZAPLETALOVÁ, 1961).

It seems that the fauna change was in close connection with the change of the physico-chemical parameters. In the *Elphidium hauerinum* zone the number of the unconform contacts, bentonit and dacit tuff layers increased in comparison with the one below, indicating a more altering sedimentary environment and the strengthening of the vulcanic activity, this latter episodically induced muddy water. Futhermore the abundance of bolivinids and the nearly complete lack of the miliolinas suggest that at the boundary of *Elphidium reginum* and *Elphidium hauerinum* zones the area of the Zsámbék Basin slightly deepened and these circumtances presumably continued until the uppermost layers of this zone.

At the boundary of the *Elphidium hauerinum* and *Spirolina austriaca* zones the fauna assemblage substancially changes. The typical species of the Lower Sarmatian disappeared completely, or the number of their specimens significantly decreased. The foraminifera fauna became more diversified, because some new species appeared, mainly Haurenidae (10 species). The great numbers both of the species and specimens of this latter group characterizes this zone. In the recent seas miliolinas live in the largest quantities in shallow

and warm waters of the infralittoral zone at depths ranging from 30 to 50 m (LUCZKOWSKA, 1974; CHIERICHI et al., 1962). Moreover they are very frequent in the inner turbulent zone at 20-30 m depth (PHLEGER, 1960), which corresponds to that place where the ooid-limestone deposits. The oolit-limestone in the upper part of the sections contains in large quantities miliolinas as the centre of ooids, therefore they could not been determined. The mass occurrence of finely agglutinated species, *Schlumbergerina fabularoides* (KARRER) indicates a shallow-water sand facies at depths 10-30 m (CHIERICHI, 1962; HAIG, 1988).

As it was mentioned above miliolinas, the characteristic group of the *Spirolina austriaca* zone, are not sensitive to change of salinity. Especially in the lower layers of this zone degenerated, irregularly coiled specimens of Hauerinidae species *(Pl. II, fig. 2, Pl. XII, fig. 12-13)* occured. According BOLTOVSKOY & WRIGHT (1976) these pathological phenomena of miliolinas are connection with hypersaline conditions. *Spirolina austriaca* D'ORBIGNY, the typical species of this zone, probably suffered the changes of the salinity, because recently living *Spirolina pertusus* (FORSKÅL) is very abundant in metahaline-hypersalin areas, at water depths 0-30 m (HAIG, 1988).

Considering the above facts one can conclude, that during *Spirolina austriaca* zone there was a shallow-water lagoon in this area, which occasionally became hypersaline. This is also supported by the appearance of evaporite (anhidrit) beds in this stratigraphic level a few kilometres south from the area of the boreholes (JÁMBOR, 1974).

The high salinity and probably the re-occurrence of several Badenian species e. g. *Spirolina austriaca* may indicate an episodical communication with the Tethys during this time.

The layers of this zone contain some redeposited Badenian specimens, e. g. *Spiroplectammina* sp. and *Heterolepa dutemplei* (D'ORBIGNY), with strongly different preservation. They occur in the same stratigraphic level (in the Mány-22. borehole: 73-75 m and 85-87 m; in the Mány-17. borehole: 75-80; in the Perbál-5. borehole: 87-90 m), showing that during this time Badenian formations were on the surface near the Zsámbék Basin. Similar situation was observed by KÓKAY (1983).

Conclusion

In the Sarmatian formations of Zsámbék Basin three foraminiferal zones could be distinguished, the *Elphidium reginum, Elphidium hauerinum and Spirolina austriaca* zones. With the help of them the three studied boreholes could be correlated. Close correspondence could be established with the foraminiferal zones described from the other parts of Paratethys. The similarity is showed much rather in the predominance of the species than in the fauna components.

On the basis of the foraminifera fauna the *Elphidium reginum* zone of the Zsámbék Basin corresponds to the *Elphidium reginum* zone of the Vienna Basin and to the lower part of the Lower Sarmatian in the Eastern Paratethys (see *Table 1*). The author disagrees with the opinion of BODA (1974), that the boundary of the *Elphidium reginum* and *Elphidium hauerinum* zones – both in the Vienna Basin and in the Zsámbék Basin – coincides with the Kozárd-Tinnye boundary, as the typical foraminifera of the Lower Sarmatian, vanished completely or strongly decreased in number later, at the *Elphidium hauerinum – Spirolina austriaca* zone boundary.

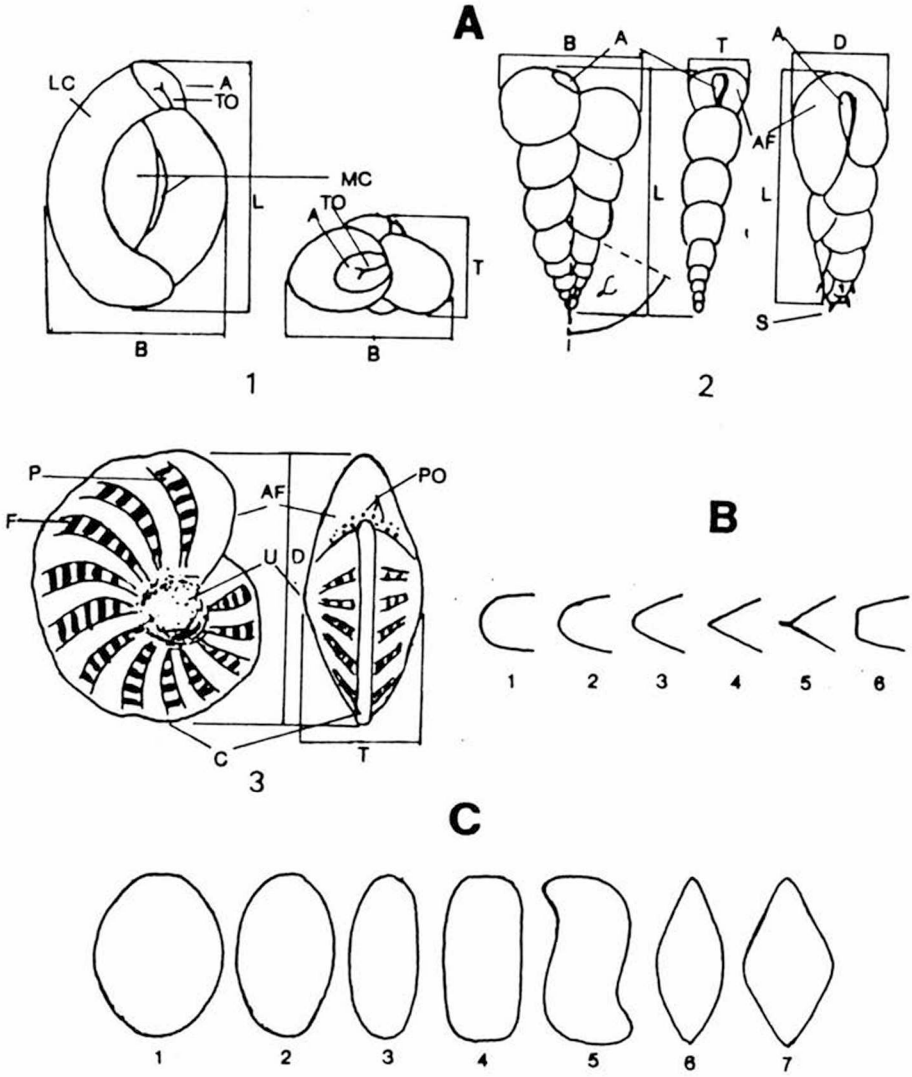
During the *Elphidium reginum* zone the foraminifera fauna was nearly similar in the whole Paratethys. The first significant fauna differance appeared between the Eastern and Western Paratethys in the *Elphidium hauerinum* zone. In the Eastern Paratethys the assemblages show high diversity and rich miliolina fauna, while in the Western Paratethys the fauna impoverished and miliolinas nearly disappeared. The foraminifera community of the Zsámbék Basin corresponds to that of the Western Paratethys, indicating a closer paleogeographical connection between the Zsámbék Basin and this area.

On the basis of the characteristic fauna change the *Elphidium hauerinum – Spirolina austriaca* zone boundary corresponds to the Volhynian – Bessarabian, that is to the Lower – Middle Sarmatian boundary. It is possible that the fauna change at the Lower-Middle Sarmatian boundary happened in time earlier in the Western than in the Eastern Paratethys, but the strata of the *Spirolina austriaca* zone probably deposited during the lower part of the Bessarabian Substage. The *Spirolina austriaca* zone could be correlated with the *Porosononion granosum* zones of the Western Paratethys. The presence and the abundance of the typical species of Almaschska Horizon (lower part of the Bessarabian Substage in Transcarpathians) suggest that close connection existed between the Zsámbék Basin and the Eastern Paratethys.

From a paleoecological point of view the foraminifera fauna of the Zsámbék Basin during the *Elphidium reginum* and *Elphidium hauerinum* zones indicates a shallow-marine basin environment with slightly varied water depth and consolidated brackish-water conditions. During the *Spirolina austriaca* zone a warm shallow-marine lagoon environment and a communication with Tethys, occasionally causing hypersaline conditions, are concluded.

Acknowledgements

I am indepted to my colleague M. MONOSTORI for sparing me so much time for discussions and consultations. Sincere thanks are due to J. BODA for his suggestions and advices. Special thanks are extended to the staff of the Electron Microscope of Eötvös Unviersity, Budapest, for their help in my using of the scanning elektron microscope. This work was supported by the OTKA foundation, contract number 3400313.



Text-fig. 1. Test morfology of important groups of the studied foraminifera. A. Dimensions and chamber arrangement: 1 – Miliolinacea, 2 – Bolivinacea, Caucasinidae and 3 – Elphidiidae. A. – aperture; AF – apertural face; B – breadth; C – carinae; D – diameter; F – fossette; L – length; LC – last chamber; MC – middle chamber; P – ponticuli (= septal bridge); PO – pores; S – spine; T – thickness; TO – tooth; U – umbilicus; α– angle betwwen the suture and the longitudinal axis of the test. B. Outline of the periphery: 1 – rounded; 2 – subrounded; 3 – subacute; 4 – acute; 5 – carinate or keeled; 6 – angular. C. shape of the test: 1 – broad-oval; 2 – oval; 3 – elongate or slender; 4 – quadrangular; 5 – sigmoid; 6 – lenticular; 7 – rhomboid.

Systematic descriptions

The material studied is deposited in the Micropaleontological Collection of Hungarian Natural History Museum, Budapest.

Terminology. The terminology used int he descriptions is elucidated in text-fig. 1.

After LOEBLICH and TAPPAN, 1990.

Phylum Protista
Subphylum Sarcodina SCHMARDA, 1871
Classis Rhizopodea VON SIEBOLD, 1845
Subclassis Lobosia CARPENTER, 1861
Ordo Foraminiferida EICHWALD, 1830
Subordo Miliolina DELAGE et HÈROUARD, 1896
Superfamily Milionicea EHRENBERG, 1839
Family Spiroloculinidae WIESNER, 1920
Genus Spiroloculina D'ORBIGNY, 1826

Spiroloculina okrojantzi BOGDANOWICH, 1947
(Pl. I, fig. 1)

1947. *Spiroloculina okrojantzi* BOGDANOWICH; BOGDANOWICH, p. 27, Tabl. 3, fig. 4a, b. fide Catalogue Ellis et Messina.
1960. *Spiroloculina okrojantzi* BOGDANOWICH; STANCHEVA, p. 15, Tabl. II. fig. 1.
1970. *Spiroloculina okrojantzi* BOGDANOWICH; DIDKOWSKI et STANOVSKAJA, p. 46, Tabl. 26, fig. 3a, b.
1974. *Spiroloculina okrojantzi* BOGDANOWICH; BRESTENSKÁ, p. 246, Taf. 2, Fig. 1.

Material. 4 slightly eroded specimens.

Description. Test large, nearly circular or broad-oval, slightly tapering at both end, strongly flattened; periphery rounded; six to nine tubular and arcaute chambers are visible from the outside; middle chambers depressed; sutures distinct and depressed; wall porcelanous, thin; surface dull and ornamented with extremely fine, oblique, longitudinal costae; aperture rounded, placed more or less obliquely at the apertural end of the last chamber, surrounding with a thin lip, bearing a low simple or bifid tooth.

Dimensions. Length: 0.6-1.0 mm; breadth: 0.5-0.8 mm; thickness 0.15-0.2 mm.

Variability. The number of the visible chambers is variable. The ornamentation may be more or less distinct.

Remarks. The specimens from Zsámbék Basin can be well identified with the type described and figured by BOGDANOWICH, 1947, which however differs in its smaller size, only 0.45-0.6 mm in lenght.

This species differs from the other *Spiroloculina* species in its nearly circular test shape, rounded periphery and surface ornamentation.

Distribution. Russia: Caucasus – Lower and Middle Sarmatian; Ukraine: Krime – Lower and Middle Sarmatian; North- Western Bulgaria: Vladimirovo and Dimovo – Lower Sarmatian; Czecho-Slovakia – Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Superfamily Cornuspiracea SCHUTTZE, 1854
Family Fischerinidae MILLETT, 1898
Subfamily Nodophthalmidiinae CUSHMAN, 1940
Genus Nodophthalmidium MACFADYEN, 1939

Nodophthalmidium aff. prima (BOGDANOWICH, 1952)

(Pl. I, fig. 2)

1970. *Sarmatiella prima* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 44, Tabl. 25, fig. 1.

Material. 2 specimens.

Description. Initial part elongated-oval, somewhat compressed; periphery rounded; three chambers visible from the outside; the last two chambers tubular, one-half coil in lenght, planispirally enrolled; sutures slightly depressed.

The uncoilled part consits of a few elongate chambers, increasing in size, inflated at the base, tapering and depressed at the aperture; sutures depressed; wall porcelanous thick and dull; surface smooth; aperture slit-like, somewhat bends down at both ends, without a tooth.

Dimensions. Initial part: length: 0.22-0.27 mm; breadth: 0.10.0.14 mm; thickness 0.07-.10 „; Uniserial part: length: 0.26-0.30 mm; maximum diameter: 0.15-0.18 mm.

Variability. The uniserial part may have anoblique position to the coiling axis.

Remarks. Our specimens much resemble the type of *Sarmatiella prima* BOGDANOWICH figured by BOGDANOWICH, 1952, the original figure published in DIDKOWSKI et SATANOVSKAJA, 1970.

Distribution. Ukraine (Black Sea Foredeep) and Azerbaidjan – Middle Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Nodophthalmidium asperum n. sp.
(Pl. I, fig. 5)

Holotypus: Pl. I, fig. 5.
Locus typicus: Perbál-5. borehole, depth 142-144 m, Zsámbék Basin, Hungary.
Stratum typicum: Sarmatian, upper part of the *Elphidium reginum* zone.
Derivatio nominis: asperum (latin) – rough surface.

Material. 2 specimens.

Diagnosis. Initial part planispirally enrolled; chambers of uniserial part are conical shape, compressed at the apertural end; slit-like aperture; surface covered with short spine-like ornamentation, forming a rough texture.

Description. Initial part oval, planispirally enrolled; periphery rounded; three chambers visible from the exterior; the last chambers one-half coil in length; chambers elongated somewhat broader at the base; middle chambers elongated, slightly convex; sutures depressed; aperture more or less rounded, with a tooth.

Uniserial part long, consists of a few conical-shape chambers, gradually increasing in size; chambers broad and inflated at the suture, narrowed and slightly compressed at the upper one-third part; sutures strongly depressed.

Wall of test relatively thick; surface rough, caused by small irregular spines; aperture slit-like and somewhat broader at both ends, surrounding with a smooth, more or less thickened lip, which inclined at both ends, without a tooth.

Dimensions. Holotype: initial part: length: 0.30 mm; breadth: 0.27 mm; thickness: 0.12-0.15. The last chamber of the uniserial part: length: 0.42 mm; maximum diameter: 0.22 mm.

Remarks: The distictive feature of this species is the rough surface. This species does not resemble any form known to the author from literature.

Distribution. Hungary: Zsámbék Basin – Lower Sarmatian, *Elphidium reginum* zone.

Nodophthalmidium rugosum n. sp.
(Pl. I, figs. 3-4)

Holotypus: Pl. I, fig. 4.
Paratypus: Pl. I, fig. 5.
Locus typicus: Mány-17. borehole, depth 147.1-147,5 m, Zsámbék Basin, Hungary.
Stratum typicum: Sarmatian, upper part of the *Elphidium reginum* zone.
Derviatio nominis: rugosa (latin) – wrinkled.

Material. 10 specimens (2 complete).

Diagnosis. Convex middle chamber in the planispirally coiled part; in the uniseral part chambers are elongated, with slit-like aperture, bordered with a smooth thickened lip; surface ornamented fine irregular grooves.

Description: Initial part oval; periphery rounded; three or four chambers visible from the outside; the fourth chamber poorly or not visible; chambers tubular, one-half coil in lenght, planispirally enrolled, last chamber strongly curved at the base; middle chambers elongated and convex; sutures depressed; aperture rounded, surrounded with a thickened rim, without a tooth.

The uniserial part consists of a few long, slender chambers, slightly inflated at the base, tapering and somewhat depressed at the aperture; sutures depressed. Wall porcelanous, thick and dull; surface covered with fine irregular, longitudinal grooves, often bifurcated or anastomosed; aperture slit-like, somewhat bends down at both ends, without a tooth.

Dimensions. Holotype: initial part: length: 0.29 mm; breadth: 0.18 mm; thickness 0.11 mm; Uniserial part: length: 0.34 mm; maximum diameter: 0.15 mm; Paratype: initial part: length: 0.34 mm; breadth: 0.24 mm; thickness 0.12 mm.

Variability: The intensity of the ornamentation is variable.

Remarks: This species is close to *Nodophthalmidium moldawiensis* BOGDANOWICH, 1952, which however differs in its narrower aperture, in the bent down at both ends and in oramentation, the distinctly longitudinal striae.

This species differs from *Nodophthalmidium aff. prima* (BOGDANOWICH, 1952) in its more slender chambers of uniserial part and the ornamentation.

Distribution. Hungary: Zsámbék Basin – Sarmatian, upper part of the *Elphidium reginum* zone to the lower part of the *Spirolina austriaca* zone.

Subfamily Nodobaculariinae CUSMAN, 1927
Genus Nodobacullariella CUSMAN et HANZAWA, 1937

Nodobacullariella didkowskii BOGDANOWCH, 1952
(Pl. I, fig. 6)

1970. *Nodobacullariella didkowskii* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 52, Tabl. 30, fig 6a, b.

Material. 7 specimens.

Description. Test nearly circular, strongly depressed; periphery rounded or slightly subacute; six to eight chambers visible from the outside; last two chambers large, uniform in width, oval in cross-section; middle chambers small, depressed in both sides; sutures depressed, distinct; wall porcelaneous, thick; surface smooth, dull; aperture large, oval, with an everted lip, without a tooth.

Dimensions. Length: 0.45-0.6 mm; breadth: 0.38-0.56 mm; thickness 0.17-0.24 mm.

Variability. The number of the visible inner chambers is variable.

Remarks. This species is determined on the basis of original figures of BOGDANOWICH published by DIDKOWSKI and SATANOVSKAJA (1970). The distinctive features of this species are the nearly circular test shape and the large oval aperture.

Distribution. Ukraine: Volhyn-Podolian Platform – Upper Badenian and Lower Sarmatian; Russia: Eastern Precaucasus – Konka Horzint: Zsámbék Basin – Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone.

Nodobacullariella ovalis VENGLINSKI, 1958
(Pl. I, figs. 7-9)

1958. *Nodobacullariella ovalis* VENGLINSKI; VENGLINSKI, p. 91, Tabl, 18, fig. 1.
1962. *Nodobacullariella ovalis* VENGLINSKI; VENGLINSKI, Tabl. VII, fig. 5.
1965. *Nodobacullariella ovalis* VENGLINSKI; KORECZ-LAKY, p. 354, Taf. II. fig. 2.
1970. *Nodobacullariella ovalis* VENGLINSKI; DIDKOWSKI et SATANOVSKAJA, p. 52, Tabl. 31, fig. 4.

1973. *Nodobaculariella ovalis* VENGLINSKI; KORECZ-LAKY, Pl. III. fig. 2.
1974. *Nodobaculariella ovalis* VENGLINSKI; BRESTENSKÁ, p. 247, Taf. 1, Fig. 2.

Material. About 30 specimens.

Description. Test oval, flattened; periphery rounded; three or four chambers visible from the exterior; chambers one-half coil in length and tubular, in the lower part strongly inflected, middle chamber large, convex; fourth chamber poorly visible or lacking; sutures distinct; wall porlelaneous, relative thick; surface smooth, dull; aperture circular to oval, bordered by a thick rim, without a tooth.

Dimensions. Length: 0.34-0.6 mm; breadth: 0.22-0.36 mm; thickness 0.13-0.20 mm.

Variability. The test shape ranges from oval to nearly rounded.

Remarks. Morfologically this species is close to *Nodobaculariella sulcata* (REUSS), but the characteristic remarks are the smooth surface and the rounded periphery.

Distribution. Ukraine: Transcarpathians – Lower Sarmatian; Hungary: Tokaj Mountains, Zsámbék Basin – Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone.

Nodobaculariella sulcata (REUSS, 1849)
(Pl. I, fig. 10-12)

1849. *Articulina sulcata* REUSS; REUSS, p. 383, Taf. IV, Fig. 13-17.
1958. *Nodobaculariella sulcata* (REUSS); VENGLINSKI, p. 89, Tabl. XVII. fig. 4a, b, c.
1964. *Nodobaculariella sulcata* (REUSS); KORECZ-LAKY, Taf. III, Fig. 5.
1970. *Nodobaculariella sulcata* (REUSS); DIDKOWSKI et SATANAOVSKAJA, p. 53, Tabl. 31, fig. 6.
1974. *Nodobaculariella aff. sulcata* (REUSS); BRESTENSKÁ, p. 247, Taf. 1, Fig. 1.

Material. About 50 specimens.

Description. Test oval, flattened; periphery subacute; three or four chambers visible from the exterior; chambers one-half coil in length, thick tubular, in the lower part strongly inflected, middle chamber small, elongated,

forth chamber usually poorly visible or lacking; sutures distinct; wall calcareous, porcelaneous, relative thick; surface dull, covered with irregular longitudinal ribs; aperture oval at the end of a neck or lacking, with thin rim, without a tooth.

Dimensions. length: 0.35-0.6 mm; breadth: 0.32-0.42 mm; thickness 0.11-0.20 mm.

Variability. Test more or less elongated. Variable features are the length of the final chamber and the intensity of the ornamentation.

Remarks. The test shape is the same as the description and illustration of the type described by REUSS, 1849, but the latter specimens differ in their regular, longitudinal striae.

VENGLINSKI (1958) figured specimens with broad-rounded periphery, but described sometimes that may be subacute. The more distinctive remarks of this species are the longitudinal ornamentation and the oval aperture at the end of a longer or shorter neck, surrounded by a thickened rim.

Distribution. Eocene – Recent. Recently lives in the oceans and seas between 72 to 790 m (DIDKOWSKI, 1970). In Lower Sarmatian, in the large *Elphidium* zone this species wide-spread in Central-Paratethys (BRESTENSKÁ, 1974).

Original description of REUSS from Felső-Lapugy, Romania and Wieliczka, Poland from Miocene. Ukraine: Transcarpathians – Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone.

Family Hauerinidae SCHAWAGER, 1876
Subfamily Siphonapertinae SAIDOVA, 1975
Genus Schlumbergerina MUNIER-CHALMAS, 1882

Schlumbergerina fabularoides (KARRER, 1865)
(Pl. II, fig. 1-4)

1865. *Quinqueloculina fabularoides* KARRER; KARRER, p. 704, Taf. 1, Fig. 3.
1865. *Quinqueloculina transilvaniae* KARRER; KARRER, p. 704, Taf. 1, Fig. 4.
1974. *Miliola fabularoides* (KARRER); LUCZKOWSKA, p. 96, Pl. XIV, figs. 1-3, test-fig. 34/1.

Material. Over 500 specimens.

Description. Test large, quadrangular- oval or oval; subtriangular to oval in cross-section; periphery rounded; five chambers visible from the outside,

chambers elongated, tubular, one-half coil in length in quinqueloculine arrangement; middle chambers long, convex and more or less elevated; sutures depressed; wall finely agglutinated; surface slightly rough and dull; aperture nearly circular to subtriangular and convex, somewhat prominent or flush with the periphery, trematophore, with numerous rounded openings.

Dimensions. Length: 0.5-1.8 mm; breadth: 0.3-0.95 mm; thickness 0.27-0.55 mm.

Variability. The test shape is variable, often appeared irregular-shape chambers. Frequently six chambers can be seen. Sometimes the last chambers do not reach the top of the test, forming a lateral position of the aperture. The aperture is surrounded with crenulate border and bearing a low simple tooth if the termatophore damaged.

Remarks. In our specimens the quadrangular test shape is more common, in contrast to description of LUCZKOWSKA. The irregular chambers appeared frequently. This species occured in only one sample (Mány-22. borehole, 40-43 m), but in large quantities (about 8000 specimens in 100 g rocks) and amounts over 30% of the total foraminifera fauna.

Distribution. Romania: Lapugy in Transylvania – Badenian; Poland: Niskowa – Upper Badenian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austrica* zone.

Genus Siphonaperta VELLA, 1957

Siphonaperta longidentata n. sp.
(PL. II, figs. 5-8)

Holotypus: Pl. II, fig. 8.
Paratypus: Pl. II, figs. 5-7.
Locus typicus: Mány-17. borehole, depth 147.1-147.5 m, Zsámbék Basin, Hungary
Stratum typicum: Lower Sarmatian, *Elphidium reginum* zone.
Derivatio nominis: longidentata (latin) – long tooth.

Material. 33 speciemens.

Diagnosis. Sigmoid test shape; surface covered with fine sand grains; aperture oval with a long simple tooth.

Description. Test sigmoid or sometimes oval; periphery rounded; three to five chambers visible from the outside; chambers tubular; the last chamber

strongly inflected in the lower part, usually has short extension at the base end and longer, distinct extension at the aperture; middle chambers long, elongated and more or less elevated; sutures slightly depressed, indistinct; wall calcareous, agglutinated with fine sand grains; surface rough; aperture oval, somewhat boardered at the upper end, surrounded with a smooth porcelaneous, slightly inclined rim, bearing a long, slender simple tooth.

Dimensions. Holotype: length: 0.39 mm; breadth: 0.27 mm; thickness 0.25 mm. Paratypes: length: 0.33-0.42 mm; breadth: 0.24-0.33 mm; thickness 0.12-0.18 mm.

Variability. The shape of the test and the length of the extensions of both ends of the last chamber are variable.

Remarks. This species somewhat resembles to *Siphonaperta mediterranensis* BOGDANOWICH, 1950, but the latter species differs in its small round aperture, equipped with a short simple tooth.

Distribution. Hungary: Zsámbék Basin – Sarmatian, upper part of the *Elphidium reginum* zone.

Subfamily Hauerininae SCHWAGER, 1876
Genus Cycloforina LUCZKOWSKA, 1972

Cycloforina badenensis D' ORBIGNY, 1846
(Pl. II, fig. 9-11)

1846. *Quinqueloculina Badenensis* D'"ORBIGNY; D'ORBIGNY, p. 299, Taf. 20, fig. 10-12.
1958. *Miliolina badenensis* D'ORBIGNY; VENGLINSKI, p. 76, Tabl. 13, fig. 3.
1968. *Quinqueloculina badenensis* D'ORBIGNY; KORECZ-LAKY, p. 148, Taf. 12, Fig. 10.
1970. *Quinqueloculina badenensis* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 18, Tabl. 8, fig. 2 a, b.
1974. *Cycloforina badenensis* D'ORBIGNY; LUCZKOWSKA, p. 73, Pl. 11, fig. 5.
1985. *Cycloforina badenensis* D'ORBIGNY; PAPP et SCHMID, p. 105, Pl. 101, fig. 6-10.

Material. Over 500 specimens.

Description. Test broad-oval; periphery angular; five chambers visible from the outside, chambers one-half a coil in lenght in cycloforina arrangement, chambers uniform in width, in cross-section trapezoid, slightly inflated, only on the last two chambers visible two ridges; large, elevated middle chambers with a visible ridge; sutures distinct, depressed; wall calcareous, imperforate, thick; surface dull; aperture circular, with a short, bifid tooth.

Dimensions. Length: 0.60–1.10 mm; breadth: 0.40–0.75 mm; thickness: 0.26-0.60 mm.

Variability. The test may sometimes be more elongated and edges of the chambers more or less acute.

Remarks. In our material the specimens are not so keeled as the ones figured by PAPP et SCHMID (1985) on plate 101, figs. 7, 10.

Distribution. Austria: Baden, Vienna Basin – Badenian; Poland: Benczyn, Bogoria, Karsy, Korytnica – Badenian and Lower Sarmatian; Ukraine: Transcarpathians, North Caucasian, Southern part of the Russian Platform – Miocene; Hungary: Mecsek Mts. – Badenian and Lower Sarmatian; Zsámbék Basin – Sarmatian.

Cycloforina contora (D'ORBIGNY, 1846)
(Pl. III, fig. 1-3)

1846. *Quinqueloculina Juelana* D'ORBIGNY; D'ORBIGNY, p. 298, Taf. 20, Fig. 1-3.
1846. *Quinqueloculina contorta* D'ORBIGNY; D'ORBIGNY, p. 298, Taf. 20, Fig. 4-6.
1846. *Quinqueloculina Rudolphina* D'ORBIGNY; D'ORBIGNY, p. 299, Taf. 20, Fig. 7-9.
1964. *Quinqueloculina contorta* D'ORBIGNY; KORECZ-LAKY, p. 478. Taf. 2, Fig. 10.
1968. *Quinqueloculina contorta* D'ORBIGNY; KORECZ-LAKY, p. 59, Taf. 4. Fig. 4.
1968. *Quinqueloculina juleana* D'ORBIGNY; KORECZ-LAKY, p. 59.
1970. *Quinqueloculina contorta* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 22, Tabl. 9, fig. 6.

1974. *Cycloforina contorta* (D'ORBIGNY); LUCZKOWSKA, p. 74, part 1. Pl. 12, fig. 3, part 2, Pl. 11, figs. 2, 3, Text-fig. 26.
1985. *Cycloforina contorta* (D'ORBIGNY); PAPP et SCHMID, p. 104-105, Pl. 100, figs. 1-11, Pl. 101, figs. 1-5.
1991. *Cycloforina contorta* (D'ORBIGNY); CIMMERMAN and LANGER, p. 32,pl. 27, figs. 7-11.
1991. *Cycloforina juleana* (D'ORBIGNY); CIMERMAN and LANGER, p. 33, pl. 28, figs. 1-2.

Material. About 350 specimens.

Description. Test narrowly-oval; periphery angular; in cross-section flattened or triangular; five chambers visible from the outside, chambers one-half a coil in lenght in cycloforina arragement, in the lower part strongly inflected and sometimes reach the last one, chambers long, narrow, uniform in width, sides flattened, two carinae run wide apart on the periphery, may be slightly depressed between the keels; elevated middle chambers, long, with a visible ridge; sutures distinct, depressed; wall calcareous, imperforate, thick; surface dull; aperture circular, with a short, bifid tooth.

Dimensions. Length: 0.6-1.1 mm; breadth: 0.3-0.7 mm; thickness 0.25-0.45 mm.

Variability. The shape of the test may be more slender and in cross-section has more or less parralel siedes or triangular shape. Sometimes two ridges run along the largest middle chamber. The carinae ranges from blunt to sharp. The aperture may be produced on a short neck.

Remarks. In our material the axe of the test often curved. Inspite of description of LUCZKOWSKA the rough streakly surface is not a characteristic feature, it appeared very rarely.

Distribution. Eocen to Recent. Recently lives in Mediterranean Sea (CIMERMAN and LANGER, 1991). Austria: Vienna Basin – Badenian; Ukraine – Upper Eocen-Miocen; Poland: Benczyn, Bogoria, Korytnica, Gliwice Stare, Niechobrz, Rybnica, Wieliczka – Badenian and Lower Sarmatian; Hungary: Mecsek Mts. – Badenian and Lower Sarmatian, Zsámbék Basin – Sarmatian, *Elphidium hauerinum* and *Spirolina austriaca* zone.

Cycloforina fluviata (VENGLINSKI, 1958)
(Pl. II, figs. 4-6)

1958. *Miliolina fluviata* VENGLINSKI; VENGLINSKI, p. 82, Tabl. 15, fig. 4, 5.
1960. *Miliolina fluviata* VENGLINSKI; STANCHEVA, p. 10, Tabl. 1, fig. 7.
1962. *Quinqueloculina fluviata* (VENGLINSKI); VENGLINSKI, p. 73, Tabl. 4, fig. 2.
1970. *Quinqueloculina fluviata* (VENGLINSKI); DIDKOWSKI et SATANOVSKAJA, p. 23, Tabl. 11. fig. 2.
pars 1974. *Cycloforina fluviata* (VENGLINSKI); LUCZKOWSKA, p. 76, Pl. 13, fig. 4, text-fig. 27/2.

Material. About 100 specimens.

Description. Test quadrangular-oval, elongated, flattened in cross-section; periphery rounded; five chambers visible from the outside; chambers one-half coil in length in cycloforina arrangement, broad tubular, in the lower part inflected, middle chamber long, fifth chamber usually poorly visible; sutures slightly depressed; wall thin; surface covered with longitudinal ribs; aperture circular, with a short, bifid or quadrate and slightly bifid tooth.

Variability. Variability expressed in the visible size of the fifth chamber and in the strong or weak development of ribs.

Dimensions. Length: 0.28-0.42 mm; breadth: 0.13-0.19 mm; thickness 0.09-0.18 mm.

Remarks. The specimens are same the as the original description of VENGLINSKI. Specimens of LUCZKOWSKA differ from it in the ornamentation ("surface longitudinal thick protuberences accumulated at the bottom of chambers and dissappearing towards the end"), in the broad oval-quadrangular shape of the test, and the aperture bearing a quadrate tooth.

Distribution. Ukraine: Transcarpathians – Lower and Middle Sarmatian; Northwestern Bulgaria: Vladimirovo, Pelovo – Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, from the upper part of the *Elphidium reginum* zone to the *Spirolina austriaca* zone.

Cycloforina predkarpatica (SEROVA, 1955)
(Pl. III, figs. 7-9)

1970. *Cycloforina predkarpatica* (SEROVA); DIDKOWSKI et SATANOVSKAJA, p. 30, Tabl. 18, fig. 1.
1974. *Cycloforina predkarpatica* (SEROVA); LUCZKOWSKA, p. 83, Pl. 13, figs. 8, 9, text-fig. 27/4.

Material. 46 specimens.

Description. Test quadrangular-oval to oval; subtriangular in section; periphery rounded; four or five chambers visible from the outside; chambers tubular, in the lower part inflected, straightened at the aperture; middle chambers long, convex; sutures depressed; wall thin; surface smooth, polished; aperture small, circular with a low quadrate, somewhat bifid tooth.

Dimensions. Length: 0.4-0.8 mm; breadth: 0.3-0.5 mm; thickness 0.1-0.3 mm.

Variability. The shape of the test varies from elongated oval to quadrangular-oval. Often the fourth and the fifth chambers are very narrow and poorly visible. The periphery sometimes covered with faint and irregular longitudinal grooves.

Remarks. The specimens from Zsámbék Basin are similar to the original illustration of SEROVA, 1950, and have larger test, than specimens of LUCZKOWSKA, 1974.

This species differs from *Cycloforina stomata* LUCZKOWSKA in its more quadrangular test shape, smaller aperture and lower, quadrate tooth.

Distribution. Ukraine: Precarpathian Foredeep – Lower Sarmatian; Poland: Budy, Dwikozy, Grzybów, Miechocin, Mielec, Niwka, Rytwiany, Zrecze – Loser Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Cycloforina stomata LUCZKOWSKA, 1974
(Pl. III, fig. 10-11)

1974. *Cycloforina stomata* LUCZKOWSKA; LUCZKOWSKA, p. 85, Pl. 13, fig. 5, text-fig. 27/1.

Material. 32 specimens.

Description. Test oval, tapering at both ends; periphery rounded; five chambers visible from the exterior; chambers one-half coil in length, broad tubular, middle chambers large and convex, fifth chamber narrow and usually poorly visible; sutures slightly depressed; wall thin; surface smooth, shiny; aperture large, circular or semicircular, with an everted border, bearing a short, bifid tooth.

Dimensions. Length: 0.4-0.6 mm; breadth: 0.25-0.35 mm; thickness 0.17-03 mm.

Variability. The test shape may be more or less elongated. The size of the fifth chamber is variable. The tooth ranges from narrow to quadrate.

Remarks. LUCZKOWSKA remarked, that "some specimens covered with longitudinal, irregular wrinkles", in our material such specimens did not appeare. Except of this, our specimens corresponds to Cycloforina stomata LUCZKOWSKA, 1974.

Distribution. Poland: Budy, Grzybów, Mielec, Niwka, Rytwiany – Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Cycloforina toreuma (SEROVA, 1955)
(Pl. IV. figs. 1-2)

1970. *Quinqueloculina toreuma* (SEROVA); DIDKOWSKI et SATANOVSKAJA, p. 35, Tabl. 20, fig. 4.
1974. *Cycloforina toreuma* (SEROVA); LUCZKOWSKA, p. 87, Pl. 13, fig. 3 a-c, text-fig. 29/2, 31.

Material. 22 specimens.

Description. Test nearly circular in outline; subtriangular in section; periphery rounded; four or five chambers visible from the exterior; fifth chamber usually poorly visible; chambers broad, arcaute, middle chamber large, prominent; sutures distinct, depressed; wall porcelaneous, thin; surface polished and covered with longitudinal striae, which may be bifurcated or dissappeared, stronger on the periphery and often missing from the sides of the chambers; aperture large, rounded, bearing with a low, quadrate, slightly bifurcated tooth.

Dimensions. Length: 0.3-0.46 mm; breadth: 0.24-0.36 mm; thickness 0.15-0.26 mm.

Variability. Often the fourth chamber is very small, and poorly visible and the fifth invisible. The intensity of the ornamentation is variable.

Remarks. Our specimens are very close to the description of Luczkowska, but differ in their less number of the visible chambers. This species differs from *Cycloforina vermicularis* (KARRER) in its smaller size, sharp and thinner striae. From *Cycloforina karreri ovata* (SEROVA) it differs in having aperture flush with the periphery and having irregular grooves placed only on the periphery. This species differs form *Varidentella pseudocostata* (VENGLINSKI) in its smaller size of the test, having stronger ornamentation and circular shape of the aperture.

Distribution. Ukraine: Volhyn-Podolian Platform, West Ukraine-Upper Badenian; Poland: Rytwiany, Zrecze – Lower Sarmatian; Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Cycloforina vermicularis (KARRER, 1868)
(Pl. IV, fig. 3-5)

1868. *Quinqueloculina vermicularis* KARRER; KARRER, p. 150, Taf. 3, Fig. 1.
1974. *Cycloforina vermicularis* (KARRER); LUCZKOWSKA, p. 88, Pl. 13, fig. 10, text-fig. 32.

Material. 31 specimens.

Description. Test, broad-oval, tapering at both ends; periphery subrounded or subacute; five chambers visible from the outside; chambers arcuate, uniform in width; middle chambers eleveted; sutures slightly depressed, distinct wall thick,dull surface covered by longitudinal or sometimes irregular, bifurcated and interrupted striae aperture circular, with a short tooth widening at the end.

Dimensions. Length: 0.4-0.9 mm breadth: 0.25-0.7 mm thickness 0.28-0.63 mm.

Variability. The shape of the test ranges from oval to nearly circular. In the section may be subrounded or more or less angular. The ornamentation varies from regular to irregular longitudinal striae. The aperture may be produced on a short neck.

Remarks. Dimorphism and ontogeny are discussed in detail by LUCZKOWSKA (1974). In the studied material specimens with regular, longitudinal ornamentation are more common than specimens with irregular, acuted one, such as figured by KARRER, 1868.

Distribution. Romania: Kostej in Banat, Lapugy in Transylvania – Badenian; Poland: Benczyn, Korytnica – Lower Badenian; Hungary: Zsámbék Basin – Sarmatian.

Genus Hauerina D'ORBIGNY, 1839

Hauerina irschavensis VENGLINSKI et BURINDINA, 1965
(Pl. IV, figs. 6-9)

1965. *Hauerina irschavensis* VENGLINSKI et BURINDINA; VENGLINSKI et BURINDINA, p. 72, Tabl. 1, fig. 1a, b.
pars 1965. *Hauerina subcompressa* VENGLINSKI et BURINDINA; VENGLINSKI et BURINDINA, p. 74, Tabl. 1, fig. 3a, b.
pars 1965. *Hauerina confusa* SEROVA sarmatica VENGLINSKI et BURINDINA; VENGLINSKI et BURINDINA, p. 75, Tabl. 1, fig. 5a, b.
1975. *Hauerina irschavensis* VENGLINSKI et BURINDINA; VENGLINSKI, p. 166, Tabl. 17, fig. 1-3.
1975. *Hauerina confusa sarmatica* VENGLINSKI et BURINDINA; VENGLINSKI, p. 166, Tabl. 18, fig. 6-9.

Material. About 80 species.

Description. Test circular to oval, flat, outline irregular; periphery rounded; early chambers show a quinqueloculina arragement, later planispiral with three or four chambers per whorl, chambers slightly inflated, middle chambers small, oval; sutures depressed, indistinct; wall calcareous, porcelanous; surface smooth, dull; aperture circular to triangular, large, trematophore.

Dimensions. Length: 0.36-0.73 mm; breadth: 0.22-0.71 mm; thickness 0.09-0.16 mm.

Variability. The shape of the test ranges from circular to oval. Chambers in the last whorl may have irregular arrangement.

Ontogeny. The juvenile specimens have rounded or triangular aperture and the middle chambes are convex and clearly visible, as in *Hauerina confusa sarmatica.* In adult stage the aperture is triangular and the middle chambers flat and poorly visible, as in *Hauerina irschavensis.*

Remarks. The valid figure in the original description of the *Hauerina confusa sarmatica* VENGLINSKI et BURINDINA, 1965 is fig. 3. The valid figure of *Hauerina subcompressa* VENGLINSKI et BURINDINA, 1965 is fig. 4., 5. is *Peneroplis sarmaticus* DIDKOWSKI *besarabica* VENGLINSKI, 1965. VENGLINSKI (1958) and VENGLINSKI and BURINDINA (1975) designated *Hauerina irschavensis* VENGLINSKI et BURINDINA and *Hauerina confusa sarmatica* VENGLINSKI et BURINDINA from the same stratigraphic level, they occured together. According to the description of VENGLINSKI and BURINDINA (1965) *H. irschavensis* is larger than *H. confusa sarmatica.* According to the morfologycal features and their stratigraphic distribution *Hauerina confusa sarmatica* is the juvenile stage of *Hauerina irschavensis.*

Distribution. Ukraine: Transcarpathian – Lower and Middle Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Hauerina podolica SEROVA, 1955
(Pl. IV. figs. 10-12)

1960. *Hauerina podolica* SEROVA; STANCHEVA, p. 15, Tabl. 1, fig. 5.
1970. *Hauerina podolica* SEROVA; DIDKOWSKI et SATANOVSKAJA, p. 50, Tabl. 29, fig. 6.
1974. *Hauerina podolica* SEROVA; LUCZKOWSKA, p. 92, pl. 18, figs. 3,4.

Material. 38 specimens.

Description. Test round in outline, lenticular in cross-section; three or four chambers visible from the exterior; The two outer ones are broad, with early chambers show a quinqueloculina arragement, later planispiral with two chambers per whorl, chambers slightly inflated, middle chambers small, poorly visible; sutures indistinct; wall calcareous, porcelanous; surface smooth, dull; aperture triangular, large, tremathophore.

Dimensions. Length: 0.26-0.38 mm; breadth: 0.22-0.33 mm; thickness 0.15-0.24 mm.

Variability. The shape of the test ranges from circular to broad oval.

Distribution: Ukraine: Volhyn-Podolian Platform – Upper Torton; Bulgaria: Vladimirovo (North-western Bulgaria) – Lower Sarmatian; Poland: Gliwice Stare, Ligota Zabrska, Niskowa Weglinek – Upper Badenian; Hungarian: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Genus Quinqueloculina D'ORBIGNY, 1826, emend LUCZKOWSKA, 1972.

Quinqueloculina anagallis LUCZKOWSKA, 1974
(Pl. V. figs. 1-3)

1974. *Quinqueloculina anagallis* LUCZKOWSKA; LUCZKOWSKA, p. 40, Pl. I, figs. 1a-c, 2a, b, 3a-c, text-fig. 7-9, 11/1, 4.

Material. About 80 specimens, only in quinqueloculine stage.

Description. Test large oval, somewhat tapering at both ends, triangular in cross-section; periphery acute; five chambers visible from the exterior, usually the fifth chamber very narrow; chambers broad, more or less acute, with slightly convex or flat sides; middle chambers large and acute; sutures distinct; wall relatively thick; surface more or less covered with strong or weak longitudinal striae; aperture large, oval,places in slightly oblique position, surrounded with thickened rim, bearing, a long, distally bifid tooth.

Dimensions. Length: 0.52-1.2 mm; breadth: 0.32-0.78 mm; thickness: 0.4-0.8 mm.

Variability. The periphery may be more or less acute, but not carinate. The ornamentation varies from weak longitudinal wrinkles along the edges to distinct striae, covering the hole surface of the test.

Variability and ontogeny are discussed in detail in LUCZKOWSKA, 1974.

Remarks. The test shape of these specimens much resembles Quinqueloculina pseudobuchiana LUCZKOWSKA, which differs in its smooth polished surface.

Distribution. Poland: Chomentów, Grabki Duze, Karsy, Korytnica, Leki Dolne – Lower Badenian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Quinqueloculina buchiana D'ORBIGNY, 1846
(Pl. V, figs. 4-7)

1846. *Quinqueloculina buchiana* D'ORBIGNY; D'ORBIGNY, p. 289, Taf. 18, Fig. 10-12.
1964. *Quinqueloculina buchiana* D'ORBIGNY; KORECZ-LAKY, p. 478, Taf. 3, Fig. 3.
1970. *Quinqueloculina ungeriana* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 36, Tabl. 21, fig. 2a-c.
1974. *Quinqueloculina buchiana* D'ORBIGNY; LUCZKOWSKA, p. 45, Pl. 4, figs. 1-4, text-fig. 11/2, 3, 12-14.
1985. *Quinqueloculina buchiana* D'ORBIGNY; PAPP et SCHMID, p. 99, Pl. 93, figs. 1-7, text-plate 14, fig. 4, text-plate 15.

Material. 25 specimens in quinqueloculine stage, 4 in massiline stage.

Description. Quinqueloculine stage: Test large, broad-oval, triangular in cross-section; periphery acute and keeled; five chambers visible from the exterior, often the fifth chamber visible as a ridge; chambers broad, more or less keeled, with flat sides; strongly elevated middle chambers large and acute; sutures distinct, flat; wall relatively thick; surface smooth, shiny; aperture large, oval, places in slightly oblique position, bordared with thickened rim, equiped with a long, distally bifurcated tooth.

Massiline stage: nearly circular, flattened; periphery sharply angled and keeled; chambers broad, slightly inflated; middle chambers large, bearing ridge, somewhat prominent; sutures distinct, flat; wall relatively thick; surface covered with fine longitudinal striae, accumulated at the outer part of the chambers near the edges; aperture large, oval, parallel with the periphery, with a simple distally bifurcated tooth.

Dimensions. Quinqueloculine form: length: 0.6-10.8 mm; breadth: 0.4-1.33 mm; thickness: 0.35-0.7 mm.

Variability. The shape of the test is characteristic and constant. The periphery may be more or less keeled. Surface of quinqueloculine forms sometimes covered with fine longitudinal grooves along the edges of the chambers.

Variability and ontogeny are discussed in detail in Luczkowska, 1974.

Remarks. The specimens from Zsámbék Basin are identical in detail with the descriptions and figures of LUCZKOWSKA, 1970 and PAPP et SCHMID, 1985; difference is in the appearance of the ornamentation on quinqueloculine forms.

Distribution. Austria: Vienna Basin – Badenian; Russia: Tchokrak Horizont (Middle Miocene); Poland: Brzeznica, Benczyn, Chomentów, Gliwice Stare, Karsy, Korytnica – Badenian and Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Subfamily Miliolinellinae VELLA, 1957
Genus Affinetrina LUCZKOWSKA, 1972

Affinetrian cubanica (BOGDANOWICH, 1947)
(Pl. V, figs. 8-10)

non 1958. *Miliolina aff. cubanica* BOGDANOWICH; VENGLINSKI, p. 83, Tabl. 15, fig. 2.
non 1960. *Miliolina aff. cubanica* BOGDANOWICH; STANCHEVA, p. 13, Tabl. 2, fig. 3.
1970. *Triloculina cubanica cubanica* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 55, Tabl. 32, fig. 3.
1974. *Affinetrina cubanica* (BOGDANOWICH); LUCZKOWSKA, p. 108, Pl. 26, fig. 4, text-fig. 38/5.

Material. About 70 specimens.

Description. Test small, broad oval to nearly circular, slightly tapering towards the aperture; periphery rounded; three chambers visible from the outside, in triloculina arragement; chambers broad, more inflated and somewhat curved at the base, narrowed towards the end; middle chamber narrow, somewhat elevated and oblique; sutures distinct, slightly depressed; wall calcareous, imperforted and thin; surface smooth and polished; aperture high, narrow, with arcuate border, which is bent somewhat to the back, placed slightly oblique to the penultimate chamber and filled with a long simple tooth, often jutting out over the plan of the aperture.

Dimensions. Length: 0.20-0.38 mm; breadth: 0.22-0.33 mm; thickness: 0.11-0.2 mm.

Variability. The morfology of the test is unvaried. The early chambers show a cryptoquinqueloculina arrangement.

Remarks. The arcute boarder and the oblique position of the aperture and the near circular and not flattened test shape are the major distinguishing features between this species and *Affinetrina ucrainica* (SEROVA, 1952).

The species described by VENGLINSKI (1958) and STANCHEVA (1960) has an elongated test shape and the aperture perpendicular or nearly perpendicular to the penultimate chamber, as in *Affinetrina ucrainica* (SEROVA, 1952).

Distribution. Russia: North and West Caucasus – Lower and Middle Sarmatian; Ukraine: Black sea Depression – Lower and Middle Sarmatian; Poland: Gliwice, Stare, Grabowiec, Grzybów, Weglinek, Zrecze – Upper Badenian and Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Affinetrina ucrainica (SEROVA, 1952)
(Pl. VI. figs. 1-3)

1958. *Miliolina aff. cubanica* BOGDANOWICH; VENGLINSKI, p. 83, Tabl. 15, fig. 2.
1960. *Miliolina aff. cubanica* BOGDANOWICH; STANCHEVA, p. 13, Tabl. 2, fig. 3.
1962. *Triloculina ucrainica* (SEROVA); VENGLINSKI, Tabl. 8, fig. 5 a, b, c.
1970. *Triloculina ukrainica ukrainica* SEROVA; DIDKOWSKI et SATANOVSKAJA, p. 63, Tabl. 38, fig. 8 a, b.
1974. *Affinetrina ucrainica.* (SEROVA); LUCZKOWSKA, p. 111, Pl. XXVI, figs. 3a-c, text-fig. 38/4.
1975. *Triloculina ucrainica siwaschica* DIDKOWSKI; VENGLINSKI, p. 168, Tabl. 19, fig. 4. 5.

Material. 34 specimens.

Description. Test elongated oval, flattened; periphery rounded; three chambers visible from the exterior, in triloculina arrangement; chambers broad, somewhat inflated in the lower part, straightened and narrowing towards the aperture; middle chamber small and narrow; sutures slightly depressed; wall calcareous, imperforate; surface smooth and polished; aperture high, narrow slit-like, filled with a long simple tooth, often jutting out over the plan of the aperture.

Dimensions. Length: 0.3-0.55 mm; breadth: 0.2-0.3 mm; thickness: 0.16-0.2 mm.

Variability. Sometimes the fourth chamber is visible. The test may be more or less flattened.

Remarks. The distinctive features between this species and *Affinetrina cubanica* (BOGDANOWICH) are presented in the description of the latter species.

Distribution. Ukraine: Transcarpathians, Volhyn-Podolian Platform – Upper Badenian – Middle Sarmatian; Bulgaria: Vladimirovo, Dobrusa, Krividol, Staroselci, Staverci, Orjahovina and Deleina in Moldavian Platform (Nortwestern Bulgaria) – Lower and Middle Sarmatian; Poland: Boguvice, Ligota Zrabska, Rytwiany, Weglin – Upper Badenian; Hungary: Zsámbék Basin – Sarmatian.

Genus Miliolinella WIESNER, 1931, emend. LUCZKOWSKA, 1972

Miliolinella banatiana LUCZKOWSKA, 1974
(Pl. VI, figs. 4-5)

1974. *Miliolinella banatiana* LUCZKOWSKA; LUCZKOWSKA, p. 103, Pl. 29, figs. 1-5, text-fig. 35.

Material. 24 specimens.

Description. Test ovate in outline, usually broader than longer, flattened; periphery rounded; three to five chambers visible from the outside; early chambers small, in quinqueloculine arrangemenet, two chambers in the final whorl broad, inflated, in planispiral arrengement; sutures depressed, distinct, with narrow strip along the sutures; wall calcareous, imperforate, thin; surface smooth and polished; aperture large, semicircular, with a broad and low apertural flap.

Dimensions. Length: 0.4-0.57 mm; breadth: 0.36-0.6 mm; thickness: 0.2-0.38 mm.

Variability. The test shape is variable, as the last chamber may be more or less inflated and have flattened sides. Sometimes slightly evolut. Centrally more or less depressed.

Remarks. The specimens from Zsámbék Basin can be well identified with the type described by LUCZKOWSKA, 1974.

Distribution. Poland: Ligota Zabrska, Wegline, Wierczhowika – Upper Badenian; Romania: Kostej in Banat – Badenian; Hungary: Zsámbék Basin – Sarmatian. *Spirolina austriaca* zone.

Miliolinella selene (KARRER, 1868)
(Pl. VI, figs. 6-8)

1868. *Triloculina selene* KARRER; KARRER, p. 138, Taf. 1, Fig. 12.
1970. *Quinqueloculina selene* (KARRER); DIDKOWSKI et SATANOWSKAJA, p. 32, Tabl. 18, fig. 9.
1974. *Miliolinella selene* (KARRER); LUCZKOWSKA, p. 105, Pl. 20, figs. 1, 2, text-fig. 36.

Material. 76 specimens.

Description. Test small, oval, subtriangular in cross-section; periphery rounded; three to five chambers visible from the outside, usually the fourth and fifth chambers are small, or invisible; chambers broad, widest at the base, tapering towards the aperture; elevated middle chamber placed slightly oblique; sutures somewhat depressed; wall calcareous, imperforte and thin; surface smooth and polished; aperture semicircular to low and broad arch, bearing a flap or low, tape-shape tooth.

Dimensions. Length: 0.25-0.5 mm; breadth: 0.2-0.4 mm; thickness: 0.2-0.36 mm.

Variability. Usually three chambers are visible from the exterior. The shape of the aperture and the tooth is variable.

Remarks. The shape of the aperture and the tooth are the major distinguishing features between *Miliolinella selene* (KARRER) and *Miliolinella valvularis* (REUSS).

The specimens from Zsámbék Basin can be well identified with the type described by KARRER, 1868.

Distribution. Romania: Kostej in Banat – Badenian; Russia: West-Precaucasian region. Georgia, Crimea – Middle Miocene: Ukraine: Volhyn-Podolian Platform – Lower Badenian; Hungary: Zsámbék Basin – Sarmatian. *Spirolina austriaca* zone.

In Paratethys: Oligocene – Miocene.

Genus Pseudotriloculina CHERIF, 1970 (= Sinuloculina LUCZKOWSKA, 1972)

Pseudotriloculina consobrina (D'ORBIGNY, 1846)
(Pl. VI. figs. 9-10)

1846. *Triloculina consobrina* D'ORBIGNY; D'ORBIGNY, p. 277, Taf. 17, Fig. 10-12.
1951. *Triloculina consobrina* D'ORBIGNY; MARKS, p. 40.
1958. *Miliolina consobrina* (D'ORBIGNY); VENGLINSKI, p. 80, Tabl. XV, fig. 3 a-c.
1958. *Miliolina consobrina* (D'ORBIGNY) var. nitens REUSS; VENGLINSKI, p. 82, Tabl. XV, fig. 1 a-c.
1960. *Miliolina consobrina* (D'ORBIGNY) var. nitens REUSS; STANCHEVA, p. 11, Tabl. I, fig. 1 a.
1960. *Miliolina consobrina* (D'ORBIGNY) var. sarmatica BOGDANOWICH; STANCHEVA, p. 11, Tabl. I, fig. 6.
1968. *Triloculina consobrina* D'ORBIGNY; KORECZ-LAKY, p. 67, Taf. I, fig. 12.
1970. *Triloculina consobrina consobrina* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 21, Tabl. 10, fig. 10-12.
1973. *Triloculina consobrina* D'ORBIGNY; KORECZ-LAKY, Pl. I, fig. 12.
1974. *Sinuloculina consobrina* (D'ORBIGNY); LUCZKOWSKA, p. 123, Pl. XXV, figs. 5-7, text-fig 40.
1975. *Quinqueloculina consobrina* (D'ORBIGNY); VENGLINSKI, p. 157, Tabl. XV, fig. 2.
1985. *Sinuloculina consobrina* (D'ORBIGNY); PAPP et SCHMID, p. 95, Pl. 88, Fig. 5-10, text-plate 14, fig. 2.

Material. About 500 specimens.

Description. Test slender, flattened, tapering at the aperture; periphery rounded, three or five chambers visible from the exterior, chambers one-half coil in lenght, broader at the base, the last chamber often extended forming a short neck, middle chambers long, narrow and oblique, usually the fourth and fifth chambers poorly or not visible; sutures indistinct; wall thin; surface smooth, polished; aperture small, circular, bearing a short, bifid tooth.

Dimensions. Length: 0.5-1,0 mm; breadth: 0.2-45 mm; thickness: 0.2-0.3 mm.

Variability. Variable features are the length of the extension of the last chamber, which occasionally dissappeares, producing a more or less quadrangular shape of the test. The periphery may be subacute.

Remarks. This is a very well-known and common species. It differs from *Sinuloculina nitens* (REUSS, 1950) in broader oval test and oblique position of the middle chamber.

Distribution. Austria: Nussdorf, Baden, Vienna Basin – Badenian and Sarmatian; Poland: Regions of Wadowice, Wieliczka, Chmielnik – Badenian and Lower Sarmatian; Ukraine: Transcarpathians – Lower Sarmatian, Krim – Miocene; North Caucase – Miocene; Hungary: Mecsek Mts. – Badenian and Lower Sarmatian, Zsámbék Basin – Sarmatian.

In Lower and Middle Sarmatian this species were cosmopolitan in Paratethys.

Pseudotriloculina inflata (D'ORBIGNY, 1826)
(Pl. VI, figs. 11-13)

1826. *Triloculina inflata* D'ORBIGNY; D'ORBIGNY, p. 300,in Catalogue Ellis et Messina.
1846. *Triloculina inflata* D'ORBIGNY; D'ORBIGNY, p. 278. Taf. 17, Fig. 13-15.
1970. *Tirloculina inflata inflata* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 57, Tabl. 34, fig. 4.
1974. *Sinuloculina inflata* D'ORBIGNY; LUCZKOWSKA, p. 126, Pl. XXIV. fig. 6.
1985. *Triloculina inflata* D'ORBIGNY; PAPP et SCHMID, p. 95, Pl. 89, Fig. 1-3.

Material. 28 specimens.

Description. Test broad, quadrangular-oval, oval in section; periphery rounded; three chambers visible from the outside; chambers broad, tubular, in the lower part strongly inflected, straightened toward the aperture; sutures slightly depressed; wall calcareous, relative thick; surface smooth, polished; aperture large, circular, with a robust, bifid tooth.

Dimensions. Length: 0.6-1.2 mm; breadth: 0.4-0.72 mm; thickness: 0.34-0.52 mm.

Variability. Sometimes only two chamber are visible from the exterior.

Remarks. Our specimens are similar to the original description and illustration of this species published by D'ORBIGNY in 1846, having a

broad-oval shape of the test. In contrast to the specimens described and figured by LUCZKOWSKA (1974) they have slenderer shape, but the other features are the same.

Distribution. Austria: Nussdorf, Vöslau, Vienna, Basin – Badenian; Poland: Bogoria, Grabowiec, Niskowa, Rybnica, Weglinek, Wieliczka – Badenian and Lower Sarmatian; Ukraine: Volhyn-Podolian Platform, Predcarpathian Foredeep, Black Sea Depression – Upper Badenian; South Ukraine – Pliocene; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

In the Upper Badenian this species was cosmopolitian in Paratethys. Recently lives in Medierrenean Sea (LUCZKOWSKA, 1974).

Genus Triloculina D'ORBIGNY, 1826, emend. LUCZKOWSKA, 1972

Triloculina gibba D'ORBIGNY, 1846
(Pl. VII. figs. 1-2)

1826. *Triloculina gibba* D'ORBIGNY; D'ORBIGNY, p. 133, Nr. 3, fide Catalogue Ellis et Messina.
1846. *Triloculina gibba* D'ORBIGNY; D'ORBIGNY, p. 274, Taf. 16, Fig. 22-24.
1846. *Triloculina austriaca* D'ORBIGNY; D'ORBIGNY, p. 275, Taf. 16. Fig. 25-27.
1846. *Triloculina inornata* D'ORBIGNY; D'ORBIGNY, p. 279, Taf. 17, Fig. 16-18.
1958. *Miliolina austriaca* (D'ORBIGNY); VENGLINSKI, p. 65, Tabl. 13, fig. 1.
1964. *Triloculina austriaca* D'ORBIGNY; KORECZ-LAKY, p. 478, Taf. 1, Fig. 13.
1968. *Triloculina gibba* D'ORBIGNY; KORECZ-LAKY, p. 67.
1968. *Triloculina austriaca* D'ORBIGNY; KORECZ-LAKY, p. 67, Taf. I, Fig. 4.
1970. *Triloculina austriaca* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 54, Tabl. 32, Fig. 1.
1970. *Triloculina gibba gibba* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 56, Tabl. 33, Fig. 3.
1973. *Triloculina austriaca* D'ORBIGNY; KORECZ-LAKY, pl.1, fig. 8.
1974. *Triloculina gibba* D'ORBIGNY; LUCZKOWSKA, p. 134, pl. XXIII, Fig. 2a-c; Text-fig. 46/2.
1975. *Triloculina gibba* D'ORBIGNY; VENGLINSKI, p. 167, Tabl. 19, Fig. 3.
1985. *Trilocullina gibba* D'ORBIGNY; PAPP et SCHMID, p. 93, Pl. 86, Fig. 1-4, text-plate 14, fig. 1; p. 94, Pl. 86, Fig. 5-7; p. 95, Pl. 89, fig. 4-6.

Material. 18 specimens.

Description. Test broad-oval, tapering at both ends; subtriangular in section; periphery rounded; two or three chambers visible from the exterior; chambers broad, inflated, middle chamber inflated; sutures depressed; wall calcareous, thick; surface smooth; aperture circular, bearing a large bifid tooth.

Dimensions. Length: 0.4-0.8 mm; breadth: 0.34-76 mm; thickness: 0.3-0.5 mm.

Variability. The size of the middle chamber is variable, sometimes only two chambers are visible, as in T. bipartia. The chambers may be more or less inflated. Occasionally chambers have more or less rounded edges.

Remarks. Triloculina austriaca D'ORBIGNY, *T. inornata* D'ORBIGNY, and *T. bipartia* D'ORBIGNY differ from *T. gibba* D'ORBIGNY only in the features mentioned above. In our material the specimens with different morfology occured together, for which reasons we accept the opinion of PAPP et SCHMID (1985), that these species belong to *T. gibba* D'ORBIGNY.

Distribution: Austira: Nussdorf, Vöslau, Vienna Basin – Badenian; Poland: Benczyn, Bogoria, Bogucice, Grabowiec, Karsy, Rybnica, Weglinek – Badenian and Lower Sarmatian; Ukraine: Volhyn-Podolian Platform, Precarpathian Foredeep – Badenian; Black Sea Depression – Upper Badenian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

This species was frequent in Lower and Middle Sarmatian (BRESTENSKA, 1974), recently lives in Adriatic Sea (LUCZKOWSKA, 1974).

Triloculina intermedia KARRER, 1868
(Pl. VII, figs. 3-4)

1868. *Triloculina intermedia* KARRER; KARRER, p. 138, Taf. 1, Fig. 1.
1958. *Miliolina intermedia* (KARRER); VENGLINSKI, Tabl. 77, Tabl. XIV, fig. 1.
1970. *Triloculina intermedia* KARRER; DIDKOWSKI et SATANOVSKAJA, p. 58, Tabl. 35, fig. 3.
1974. *Triloculina intermedia* KARRER; LUCZKOWSKA, p. 136, Pl. 23, fig. 1, text-fig. 46/4.

Material. 7 specimens.

Description. Test irregularly circular, triangular in cross-section; periphery angular, keeled; three chambers visible from the outside; two last chambers large, inflated, tapering at both ends, trapezoid in cross-section, bear two strong ridges placed wide apart on the periphery; third chamber small, convex, with one ridge; sutures depressed, distinct; wall thick; surface smooth; aperture circular or subtriangular, bordered by everted, rim, with a sort, bifid tooth.

Dimensions. Length: 0.5-0.9 mm; breadth: 0.4-0.7 mm; thickness: 0.5-0.8 mm.

Variability. The edges of the chambers may be more or less sharp and occasionally waved.

Remarks. Our specimens are very similar to the illustration of KARRER, having distinct ridges.

Distribution. Romania: Kostej in Banat, Buitur – Badenian; Ukraine: Volhyn-Podolian Platform, Precarpathian Foredeep – Middle Miocene, Transcarpathians – Upper Badenian and Lower Sarmatian; Poland: Karsy, Korytnica, Niskowa – Lower Badenian; Hungary. Zsámbék Basin – Sarmatian. Recently lives in Mediterranean Sea (LUCZKOWSKA, 1974).

Genus Varidentella LUCZKOWSKA, 1972

Varidentella latelacunata (VENGLINSKI, 1953)
(Pl. VII. figs. 5-6)

1958. *Miliollina latelacunata* VENGLINSKI; VENGLINSKI, p. 79, Tabl. 14, fig. 3.
1960. *Miliolina latelacunata* VENGLINSKI; STANCHEVA, p. 12, Tabl. I, fig. 2.
1970. *Miliolina latelacunata* VENGLINSKI; DIDKOWSKI et SATANOVSKAJA, p. 26, Tabl. 14, fig. 1.
1974. *Varidentella latelaculata* VENGLINSKI; LUCZKOWSKA, p. 140, Pl. 27, figs. 7, 8.

Material. About 400 specimens.

Description. Test oval, slender; periphery rounded; four or five chambers visible from the outside; chambers one-half coil in length, tubular, narrow, in

the lower part somewhat inflected; elevated middle chambers long, convex; sutures strongly depressed, distinct; wall calcareous, imperforate; surface dull; aperture rounded to oval, bordered by erverted rim, bearing low, broad tooth slightly bifid at the end.

Dimensions. Length: 0.4-0.65 mm; breadth: 0.24-0.37 mm; thickness: 0.14-0.2 mm.

Variability. The shape of the test may be oval or narrowly oval. The shape of the aperture ranges from rounded to oval. The tooth is variable, usually broad, but may be narrow.

Remarks. The most distinctive features of this species are the long and tubular chambers, the strongly depressed sutures and the variable shape of the aperture.

Distribution. Ukraine: Transcarpathians – Lower Sarmatian; Poland: Budy, Grzybów, Mielec, Rytwiany, Zrecze – Lower Sarmatian; Bulgaria: Vladimirovo, Staroselci, Staverni, Orjahovina, Dimovo (Nortwestern Bulgaria) – Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium hauerinum* and *Spirolina austriaca* zone.

Varidentella pseudocostata (VENGLINSKI, 1958)
(Pl. VII, figs. 7-9)

1958. *Miliolina pseudocostata* VENGLINSKI; VENGLINSKI, p. 70, Tabl. 10, fig. 1-3, Tabl. 11, fig. 1-3.
1962. *Quinqueloculina pseudocostata* (VENGLINSKI); VENGLINSKI, p. 74, Tabl. 4, fig. 3, 4.
1970. *Quinqueloculina pseudocostata* (VENGLINSKI); DIDKOWSKI et SATANOVSKAJA, p. 31, Tabl. 17, fig. 5.
1973. *Quinqueloculina pseudocostata* (VENGLINSKI); KORECZ-LAKY, Pl. II, fig. 5.
1974. *Varidentella pseudocostata* (VENGLINSKI); LUCZKOWSKA, p. 140, Pl. 26. Fig. 7.
1975 *Quinqueloculilna pseudocostata* (VENGLINSKI); VENGLINSKI, p. 159, Tabl. 13, fig. 3.

Material. 36 specimens.

Description. Test broad-oval to circular in outline; oval or triangular in section; periphery broadly-rounded; three to five chambers visible from the exterior, fifth chamber usually poorly visible; chamber broad, in the lower part inflected, slightly narrower towards the aperture, middle chamber large, convex; sutures distinct, depressed; wall porcelaneous, massive; surface covered with fine, longitudinal grooves, which stronger on the outer part of the chamber, usually disappearing near the aperture; aperture large, oval, with low, broad, quadrate, bifurcated tooth.

Dimensions. Length: 0.3-0.68 mm; breadth: 0.3-0.56 mm; thickness: 0.2-0.34 mm.

Variability. The ornamentation may be more or less strong.

Remarks. Our specimens are very close to the original description of VENGLINSKI, 1958. They differ from specimens figured by LUCZKOWSKA in their more weak and thicker grooves. The different characters from *Cycloforina toreuma* (SEROVA) and from *C. vermicularis* (KARRER) are given at the desription of *C. toreuma.* The specimens described by VENGLINSKI, 1975 probably belong to *Varidentella georgiana* LUCZKOWSKA, 1974. *V. pseudocostata* differs from this species in its larger test, large oval aperture and bifid quadrangular tooth.

Distribution. Poland: Budy, Grzybów, Rytwiany, Zrecze - Lower Sarmatian; Ukraine: Transcarpathians - Lower Sarmatian; Hungary: Zsámbék Basin - Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone.

Varidentella reussi (BOGDANOWICH, 1947)
(Pl. VII, figs. 10-11)

1958. *Miliolina reussi* BOGDANOWICH; VENGLINSKI, p. 83, Tabl. 14, fig. 1, 3.
1960. *Miliolina reussi* BOGDANOWICH; STANCHEVA, p. 10, Tabl. I, fig. 4.
1962. *Quinqueloculina reussi* (BOGDANOWICH); VENGLINSKI, p. 74, Tabl. IV, fig. 1.
1964. *Quinqueloculina reussi* (BOGDANOWICH); KORECZ-LAKY, p. 478, Taf. III, Fig. 2.
1970. *Quinqueloculina reussi reussi* (BOGDANOWICH); DIDKOWSKI et SATANOVSKAJA, p. 31, Tabl. 18, fig. 3.
1973. *Quinqueloculina reussi* (BOGDANOWICH); KORECZ-LAKY, Pl. II, fig. 4.

1974. *Varidentella reussi* (BOGDANOWICH); LUCZKOWSKA, p. 141, part I, Pl. 8, figs. 1-3, part 2, text-fig. 48-49.
1974. *Quinqueloculina reussi* (BOGDANOWICH); BRESTENSKÁ, p. 250, Taf, 1, Fig. 5.
1975. *Quinqueloculina reussi* (BOGDANOWICH); VENGLINSKI, p. 161, Tabl. 8. fig. 10.

Material. About 80 specimens.

Description. Test nearly circular to broad-oval, subtriangular in cross-section; periphery rounded; four to five chamber visible from the outside; chambers broad, compressing towards the aperture; the last chamber usually extended and inclined towards the penultimate one; elevated middle chambers slightly oblique; sutures distinct; wall porcelanous and thin; surface dull, smooth or often covered with irregular, longitudinal wrinkles; aperture low semicircular to slit-like, bordered with an everted rim, equipped with low, broad quadrangular or tape-shape tooth.

Dimensions. Length: 0.28-0.41 mm; breadth: 0.24-36 mm; thickness: 0.18-0.25 mm.

Variability. The shape of the test, the aperture and the tooth is variable. A clear review of the variability and ontogeny is presented by LUCZKOWSKA, 1974.

Remarks. The specimens from Zsámbék Basin are identical in detail with the desription and illsutration of LUCZKOWSKA, 1974.

Distribution. Ukraine: Precaucasus, Moldavia – Lower Sarmatian, Transcarpathians – Lower and Middle Sarmatian; North-Western Bulgaria: Vladimirovo, Pakevo, Pelovo, Krivodol – Sarmatian; Westslowakia – Sarmatian; Poland: Machów, Miechocin, Mokrzyszów, Piaseczno, Rytwiany – Lower Sarmatian; Hungary: Tokaj Mts. – Lower Sarmatian, Zsámbék Basin – Sarmatian, *Elphidium hauerinum* zone and the lower part of the *Spirolina austriaca* zone.

Varidentella rotunda (GERKE, 1938)
(Pl. VIII, figs. 1-2)

1958. *Miliolina akneriana var. rotunda* GERKE; VENGLINSKI, p. 79, Tabl. 14, fig. 4.
1970. *Quinqueloculina akneriana rotunda* GERKE; DIDKOWSKI et SATANOVSKAJA, p. 17, Tabl. 7, fig. 4.
1974. *Quinqueloculina akneriana rotunda* GERKE; BRESTENSKÁ, p. 248, Taf. 1, Fig. 6.
1974. *Varidentella rotunda* (GERKE); LUCZKOWSKA, p. 145, Pl. 27, figs. 5, 6, text-fig. 51.

Material. About 100 specimens.

Description. Test rounded, subtriangular in cross-section; periphery rounded; four to five chambers visible from the outside; the fifth chamber poorly or not visible; chambers broad, somewhat tapering toward the aperture; the last chamber usually extended and inclined towards the penultimate one; prominent middle chambers slightly oblique; sutures slightly depressed; wall thin; surface smooth and shiny; aperture large semicircular, usually bordared with a thickened rim, bearing a short bifid tooth.

Dimensions. Length: 0.4-0.7 mm; breadth: 0.2-0.6 mm; thickness: 0.25-0.4 mm.

Variability. The last chamber more or less extends and inclines toward the penultimate one. The aperture is surrounded with a strongly or weakly thickened rim. Ontogeny is discussed in detail by LUCZKOWSKA, 1974.

Remarks. This species somewhat close to *Varidentella pseudocostata* (VENGLINSKI, 1958), from wich it differs in ist smooth surface.

Distribution. Ukraine: Transcarpathinas – Upper Badenian – Lower Sarmatian; Russain Platform – Lower Sarmatian; Poland: Budy, Miechocin, Mokrzyszów, Grzybów, Rytwiany, Mielic, Zrecze – Upper Badenian and Lower Sarmatian; Westslovakia – Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Subfamily Tubinellinae RHUMBLER, 1906
Genus Articularia LUCZKOWSKA, 1972

Articularia articulinoides (GERKE et ISSAEVA, 1952)
(Pl. VIII, fig. 3)

? 1958. *Articulina cf. articulinoides* (GERKE et ISSAEVA); VENGLINSKI, p. 96, Tabl. XIX, fig. 2.
1960. *Articulina ? articulinoides* (GERKE et ISSAEVA); STANCHEVA, p. 13, Tabl. 2, fig. 5.
1970. *Articulina ? articulinoides* (GERKE et ISSAEVA); DIDKOWSKI et SATANOVSKAJA, p. 38, Tabl, 22, fig. 4.
? 1974. *Articulina articulinoides* (GERKE et ISSAEVA); BRESTENSKÁ, p. 253, Taf. 2, Fig. 46.
1974. *Articularia articulinoides* (GERKE et ISSAEVA); LUCZKOWSKA, p. 68, Pl. XVII. fig. 1, 2.

Material. 9 incomplete specimens (1 initial part).

Description. Initial part oval, flattened; periphery rounded; five chambers visible from the outside, one-half coil in length and in quinqueloculine or cryptoquinqueloculine arrangement; chambers tubular, strongly inflected in the lower part; middle chambers elongated; sutures tape-shaped, distinct, slightly depressed; wall relatively thick; surface smooth and dull; aperture semicircular, with low, broad tooth.

Later part uniserial; of one to three elongate, pipe-like chambers, broadering at the base and tapering towards the end; sutures depressed; surface smooth and dull; aperture rounded, bordered with a thickened lip, without a tooth.

Dimensions. Inital part: length: 0.34 mm; breadth: 0.22 mm; thickness: 0.09 mm. Uniserial part: length: 0.4-0,75 mm; maximum diameter: 0.08-1,3 mm.

Variability. The shape of the initial part is unvaried. Often the uncoiled part grows obliquely to the coiling axis. The uniserial chambers have usually a more or less irregular shape, bearing constrictions.

Remarks. The initial part of this species is very resembles *Varidentella reussi* (BOGDANOWICH), according LUCZKOWSKA (1974) *Articularia articulinoides* may have arisen from *Varientella reussi.*

VENGLINSKI (1958) and BRESTENSKÁ (1974) desribed only the uniserial part and the illustrated chambers have a regular shape.

Distribution. Russia: North Caucasus, Azerbaidjan, Moldavia and Ukraine: Volhyn- Podolian Platform – Lower Sarmatian; Poland: Gryzybów, Miechocin, Mokrzyszów, Rytwiany – Lower Sarmatian; Bulgaria: Vladimirovo in Moldavian Platform (Northwestern Bulgaria) – Lower Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Genus Articulina D'ORBIGNY, 1826

Articulina af. nitida D'ORBIGNY, 1826
(Pl. VIII, fig. 5)

1826. *Articulina nitida* D'ORBIGNY; D'ORBIGNY, p. 300. fide Catalogue Ellis et Messina.
1970. *Articulina nitida nitida* D'ORBIGNY; DIDKOWSKI at SATANOVSKAJA, p. 40, Tabl. 23, fig. 2.
1973. *Articulina nitida* D'ORBIGNY; KORECZ-LAKY, Pl. II, fig. 3.

Material. 4 chambers of the uniserial part.

Description. Test elogate, consists of a few onion-like chambers; chambers inflated at the base and narrowing toward the aperture; length: diameter rate is 1:1.5; wall relatively thick; surface covered with distinct, longitudinal costae; aperture circular, bordered with a thickened rim, without a tooth.

Dimensions. Length: 0.2-0.25 mm; maximum diameter:0.15-0.19 mm.

Remarks. The ornamentation of this species is very similar to *Articulina gibbosula* D'ORBIGNY, 1846, the latter species differs in its oval aperture, and more thickened rim. The shape of the chambers is close to *Articulina sarmatica* (KARRER, 1877), but differs in its distinct and thicker ornamentation.

Distribution. Ukraine – Upper Badenian; Hungary: Tokaj Mts. – Lower Sarmatian, Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Articulina problema BOGDANOWICH, 1952
(Pl. VIII, fig. 4)

1958. *Articulina problema* BOGDANOWICH; WENGLINSKI, p. 93, Tabl, XIX, fig. 1-10.

1960. *Articulina problema* BOGDANOWICH; STANCHEVA, p.13, Tabl. II, fig. 6.
1964. *Articulina problema* BOGDANOWICH; KORECZ-LAKY, Taf, II. fig. 5.
1970. *Articulina problema* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 41, Tabl. 23, fig. 5-7.
1973. *Articulina problema* BOGDANOWICH; KORECZ-LAKY, Pl. V, fig. 1.
1974. *Articulina problema* BOGDANOWICH; BRESTENSKÁ, p.253. Taf. 3. Fig. 1-2.
1974. *Articulina problema* BOGDANOWICH; LUCZKOWSKA, p. 71. Pl. XVII. figs. 7-10.
1975. *Articulina problema* BOGDANOWICH; VENGLINSKI, p. 164, Tabl. XV, fig. 10.

Material. About 100 specimens.

Description . Initial part relatively small, broad to elongated oval, usually quadrangular at the base and slightly tapering towards the end, flattened; periphery rounded or subrounded; three to five chambers visible from the outside; chambers one-half coil in length, in the early part planispiral, than in triloculine or quinqueloculine arrangement; chambers tubular, basically somewhat widened and strongly inflected; middle chambers nearly circular to elongated oval, sometimes slightly depressed; sutures slightly depressed; aperture more or less rounded, with a low, simple tooth.

Uniserial part long, number of the chambers up to six; chambers elongated, cone shaped, slightly inflated at the base and narrowed towards the end, and slightly increasing in size; length: diameter rate is 1:2-3; sutures strongly depressed; aperture circular, bordered with a more or less thickened lip, without a tooth.

Wall of test relatively thick; surface smooth and dull, in adult specimens covered with fine, longitudinal grooves.

Dimensions. Initial part: length: 0.15-0.31 mm; breadth: 0.11-0.16 mm; thickness: 0.08-0.1. Chamber of uniserial part: length: 0.3-0.4 mm; maximum diameter: 0.1-0.15 mm.

Variability. The shape of the initial part is variable.

Remarks. This species differs from *Articulina sarmatica* (KARRER) in its slender shape of the uncoiled chambers.

Distribution. Ukraine: Crime, Volhyn-Podolian Platform, Transcarpathians – Sarmatian; North Caucasus, Georgia, Moldavia – Lower and

Middle Sarmatian; Poland: Dwikozy,Cryzybów, Miechocin, Mokrzyszów, Rytwiany, Zrecze – Lower Sarmatian; Bulgaria: Pelovo, Dimovo, Kosava and Dlgodelci in Northwestern Bulgaria – Lower and Middle Sarmatian; Czecho-Slovakia – Sarmatian; Hungary: Tokaj Mts. – Upper part of Lower Sarmatian, Zsámbék Basin – Sarmatian, from the *Elphidium reginum* zone to the lower part of the *Spirolina austriaca* zone.

Most common in the upper part of the Lower Sarmatian.

Superfamily Alveolinacea EHRENBERG, 1839
Family Soritidae EHRENBERG, 1839
Subfamily Peneroplinae SCHULTZ, 1854
Genus Spirolina LAMARCK, 1804

Spirolina austriaca D'ORBIGNY, 1846
(Pl. VIII, fig. 6-9)

1846. *Dendritina elegans* D'ORBIGNY; D'ORBIGNY, p. 135, Taf. 7, Fig. 5, 6.
1846. *Spirolina austriaca* D'ORBIGNY; D'ORBIGNY, p. 137, Taf. 7, Fig. 7-9.
1968. *Spirolina austriaca* D'ORBIGNY; KORECZ-LAKY, p. 95, Taf. VI, Fig. 5.
1970. *Spirolina austriaca* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 65, Tabl. 40, fig. 4.
1970. *Spirolina austriaca konkia* DIDKOWSKI; DIDKOWSKI, et SATANOVSKAJA, p. 65, Tabl. 40. fig. 2.
1970. *Spirolina elegans* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 66, Tabl. 41, fig. 5.
1975. *Spirolina austriaca* D'ORBIGNY; VENGLINSKI, p. 169, Tabl. 20. fig. 1.
1985. *Spirolina austriaca* D'ORBIGNY; PAPP et SCHMID, p. 54, Pl. 44, figs. 7-9, Pl. 45, figs. 1-5.

Material. Over 500 specimens.

Description. Test large, robust; juvenile part planispirally coiled, seven to eighteen chambers, flattened; adult part free, zero to seven barrel-like chambers, in uniserial arrengement; periphery rounded; sutures distinct, in the juvenile portion ribbon-like, in the uniseral part deeply depressed; umbilicus distinct, depressed; wall calcereous, porcelaneous; surface in the juvenile stage polished, in adult stage more or less dull; ornamented with longitudinal striation at right angle to sutures, stronger on the uniserial part; aperture of juvenile specimens is elongate, lobately notched; aperture of adults rounded, lobately notched.

Dimensions. Coilled part: diameter: 0.4-0.7 mm; thickness: 0.23-0.35. Uniserail part: length up to 1 mm; diamter: 0.15-0.3 mm.

Variability. The number of the chambers is variable. The section of the uniserial part may be more or less circular. The intensity of the ornamentation on the juvenile portion ranges from strong and distinct to weak and poorly visible.

Remarks. The morfologically and ornamentically different specimens occured together. We agree with PAPP et SCHMID that *Dendritina elegans* D'ORBIGNY, 1846 corresponds to *Spirolina austriaca* D'ORBIGNY, 1846. *Dentritina* genus differs from *Spriolina* genus in its striation aligned with the direction of the coiling.

Distribution. Austira: Nussdorf, Baden, Vienna Basin – Badenian; Russia: Moldavia – Upper Badenian; Ukraine: Transcarpatians – Middle Sarmatian; Ukraine: Volhyn-Podolian Platform, Balck Sea Depression – Upper Badenian; Hungary: Mecsek Mts. – Upper Badenian, Zsámbék Basin – Sarmatian, *Spirolina austriaca* zone.

Spirolina and *Peneroplis* genus are frequent in the Middle Sarmatian in Eastern Paratethys.

Superfamily Nodosariacea EHRENBERG, 1838
Family Polymorphinidae D'ORBIGNY, 1839
Subfamily Polymorphininae D'ORBIGNY, 1839
Genus Guttulina D'ORBIGNY, 1839

Guttulina communis D'ORBIGNY, 1846
(Pl. VIII, fig. 10)

1846. *Guttulina problema* D'ORBIGNY; D'ORBIGNY, p. 224, Taf. 12, Fig. 26-28.
1846. *Guttulina communis* D'ORBIGNY; D'ORBIGNY, p. 224, Taf. 13, Fig. 6-8.
1846. *Guttulina irregularis* D'ORBIGNY; D'ORBIGNY, p. 226, Taf. 13, Fig. 9-10.
1951. *Guttulina irregularis* D'ORBIGNY; Marks, p. 47.
1962. *Guttulina problema* D'ORBIGNY; VENGLINSKI, p. XI, fig. 3.
1962. *Guttulina communis* D'ORBIGNY; VENGLINSKI, p. XI, fig.4.
1968. *Guttulina communis* D'ORBIGNY; KORECZ-LAKY, p. 85.

1968. *Guttulina problema* D'ORBIGNY; KORECZ-LAKY, p. 85, Taf. IV, Fig. 17.
1973. *Guttulina problema* D'ORBIGNY; KORECZ-LAKY, Pl. VII. fig. 13.
1985. *Guttulina communis* D'ORBIGNY; PAPP et SCHMID, p. 78-79, Pl. 70, figs. 2-12, Pl. 71, figs. 1-4.

Material. 4 specimens.

Description. Test broad-oval, tapering at the aperture, subtriangular in cross-section; periphery broadly rounded; three chambers visible from the outside; chambers inflated, more or less elongeted; sutures distinct, depressed; wall fine perforated; surface smooth; aperture small, radial, placed at the narrowed end of the final chamber.

Dimensions. Length of chamber: 0.4-0.9 mm.

Variability. The shape of the chambers may be more or less inflated and elongated. Sutures vary from depressed to flat.

Remarks. We agree with the conclusion of MARKS (1951) and PAPP et SCHMID (1985), that *Guttulina irregularis* and *G. problema* are synonymus with *G. communis.* In spite of the fact that *G. communis* was described before, MARKS named these forms as *G. irregularis.*

Distribution. Oligocene to Recent. Especially abundant in the shallow-water and sand facies during the Badenian (PAPP et SCHMID, 1985). Austria: Baden, Nussdorf, Vienna Basin – Badenian, Ukraine: Transcarpathians – Badenian; Hungary: Mecsek Mts. – Badenian, Tokaj Mts. – Middle Badenian, Zsámbék Basin – Sarmatian, upper part of the *Elphidium hauerinum* zone. Very rarely.

Family Glandulinidae REUSS, 1860
Suibfamily Oolininae LOEBLICH et TAPPAN, 1961
Genus Oolina D'ORBIGNY, 1839

Oolina mironovi (BOGDANOWICH, 1947)
(Pl. VIII, figs. 11-12)

1947. *Entosolenia mironovi* BOGDANOWICH; BOGDANOWICH, p. 28, Tabl. 3, fig. 6, fide Catalogue Ellis et Messina.

1970. *Entosolenia mironovi* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 133, Tabl. 78, fig. 7.

Material. 4 specimens.

Description. Test consists of only one chamber, small, egg-shaped, slightly flattened; periphery rounded; wall calcareous, gently perforate, thin; surface smooth, shiny, with a longitudinal, broad rib, at the lower part somewhat bent, connected to a wide rim around the aperture narrow slit, placed at the to of the test.

Dimensions. Length: 0.24-0.3 mm.

Remarks. This species differs from the other *Entosolenia* species in its characteristic longitudinal ornamentation and broad apertural rim. VENGLINSKI (1958) described *E. isa* VENGLINSKI, 1958 and *E. marginata* (WALTER et BOYS, 1784) from Transcarpathians, from Lower Sarmatian.

Distribution. Ukraine: Crime – Middle Badenian; Russia: North Caucasus – Middle Badenian; Hungary: Zsámbék Basin – Sarmatian *Elphidium hauerinum* zone. Very rarely.

Subordo Rotaliina DELAGE and HÈROUARD, 1896
Superfamily Bolivinacea GLAESSNER, 1937
Family Bolivinidae GLAESSNER, 1937
Genus Bolivina D'ORBIGNY, 1839

Bolivina antiqua D'ORBIGNY, 1846
(Pl. IX, fig. 1)

1846. *Bolivina antiqua* D'ORBIGNY; D'ORBIGNY, p. 240, Taf. 14, Fig. 11-13.
1961. *Bolivina antiqua* D'ORBIGNY; CICHA et ZAPLETALOVÁ, p. 160, Abb. 33.
1968. *Bolivina antiqua* D'ORBIGNY; KORECZ-LAKY, p. 101.
1970. *Bolivina antiqua* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 142, Tabl. 82, fig. 2.
1975. *Bolivina antiqua* D'ORBIGNY; VENGLINSKI, p. 199, Tabl. XXXIV, fig. 6.
1985. *Bolivina antiqua* D'ORBIGNY; PAPP et SCHMID, p. 83, Pl. 77, Figs. 1-6.

Material. About 30 specimens.

Description. Test elongated flattened; periphery subacute; biserial throughout; the number of chambers up to twenty six; proloculus large; chambers low, broad, gradually increasing in size; length: breadth rate is 4:1; sutures slightly depressed and straight; there is an angle of 40° between the sutures and the logitudinal axe of the test; wall hyaline; surface finely perforate on the inner part of the chambers and imperforate at the sutures; pustules appeare on the inner part of the latest chambers; aperture a loop at the apertural face.

Dimensions. Length: 0.2-0.7 mm; breadth: 0.1-0.18 mm.

Remarks. Our specimens differ from the specimens of CICHA et ZAPLETALOVÁ (1961) and PAPP et SCHMID (1985) in the more distinct pustules.

Distribution. Neogene, widely distributed. Austria: Baden – Badenian; Ukraine: Volhyn-Podolian Platform, Transcarpathians – Upper Badenian and Lower Sarmatian; West-Carpathians – Aquitanian to Middle Badenian; Hungary: Mecsek Mts. – Badenien, Zsámbék Basin – Sarmatian, upper part of the *Elphidium hauerinum* zone.

Bolivina moldavica DIDKOWSKI, 1959
(Pl. IX, fig. 2)

1961. *Bolvina moldavica granensis* CICHA et ZAPLETALOVÁ; CICHA et ZAPLETALOVÁ, p. 156, Abb. 29.
1970. *Bolivina modavica* DIDKOWSKI; DIDKOWSKI et SATANOVSKAJA, p. 143, Tabl. 82, fig. 7.
1974. *Bolivina moldavica granensis* CICHA et ZAPLETALOVÁ; BRESTENSKÁ, p. 256, Taf. 3, Fig. 6.

Material. Over 1000 specimens.

Description. Test elongated, compressed; periphery subrounded; biserial throughout; the number of chambers fourteen to twenty; proloculus relative large; gradually enlarging chambers are low and broad; length: breadth rate is 1.5-2:1; sutures distinct, slightly depressed and somewhat curved towards the initial part of the test, sometimes bearing one or two lobes; there is an angle of 60-65° between the sutures and the logitudinal axe of the test; wall hyaline, finely perforate; surface ornamented with imperforate, irregularly anastomosing costae; aperture a slit, broadering at the suture on the apertural face.

Dimensions. Length: 0.2-0.5 mm; breadth: 0.1-0.25 mm.

Variability. The shape of the test may be more or less broad at the apertural end. The intensity of the ornamentation is variable. The appearence of one or two lobes is occassional. The longitudinal plane of the test is often turned.

Remarks. Bolivina moldavica granensis CICHA et ZAPLETALOVÁ differs from *Bolivina moldavica* DIDKOWSKI only in the variable characters.

Distribution. Ukraine: Volhyn-Podolian Platform – Middle Sarmatian; Russia: Moldavia – Middle Sarmatian; West-Carpathians – Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Bolivina moravica CICHA et ZAPLETALOVÁ, 1961
(Pl. IX, fig. 3)

1961. *Bolivina moravica* CICHA et ZAPLETALOVÁ; CICHA et ZAPLETALOVÁ, p. 155, Abb. 28.
1975. *Bolivina moravica* CICHA et ZAPLETALOVÁ; VENGLINSKI, p. 203, Tabl. XXXIV, fig. 9.

Material. About 50 specimens.

Description. Test slender, flattened; periphery subacute; biserial throughout; the number of chambers fourteen to eighteen; proloculus relative large; the first eight or twelve chambers are small, low and strongly increasing in size; length: breadth rate is 2,5-3:1; later chambers low, broad and nearly uniform in width; sutures distinct, strongly deepen and somewhat curved towards the initial part of the test; there is an angle of 45-50° between the sutures and the logitudinal axe of the test; wall hyaline, finely perforate; surface ornamented with imperforate, irregularly anastomosing costae; aperture a slit, broadering at the suture on the apertural face.

Dimensions. Length: 0.2-0.36 mm; breadth: 0.09-0.12 mm; thickness: 0.05–0.07 mm.

Variability. The longitudinal plane of the test is often turned. Sometimes the latest chambers are slightly inflated; irregular in shape and usually they are not in the plane of the test. The intensity of the ornamentation is variable.

Remarks. This species differs from *Bolivina moldavica granensis* CICHA et ZAPLETALOVÁ in its narrower test, strongly depressed sutures and lack of the lobes.

Distribution. West-Carpathians – Sarmatian; Austria: Jakubov in Vienna Basin – Sarmatian; Ukraine: Transcarpathians – Middle Badenian; Hungary: Zsámbék Basin – Sarmatian; *Elphidium reginum* and *Elhidium hauerinum* zone.

Bolivina sagittula DIDKOWSKI, 1959
(Pl. IX, fig. 4)

1961. *Bolivina sagittula* DIDKOWSKI; CICHA et ZAPLETALOVÁ, p. 153, Abb. 26.
1970. *Bolivina sagittula* DIDKOWSKI; DIDKOWSKI et SATANOVSKAJA, p. 144, Tabl. 82, fig. 12.

Material. 6 specimens.

Description. Test long, narrow elongated, compressed; periphery rounded; biserial throughout; the number of chambers up to thirty two; proloculus small; the first ten or twelve chambers are small, low and strongly increasing in size; later chambers low, broad and nearly uniform in width; sutures distinct, slightly depressed and straight; there is an angle of 60° between the sutures and the logitudinal axe of the test; wall hyaline, finely perforate; surface smooth; aperture a narrow loop at the apertural face bordered by a thickened and imperforate rim on one margin.

Dimensions. Length: 0.3-0.4 mm; breadth: 0.08-0.1 mm.

Remarks. The longitudinal plane of the test is often turned.

Distribution. West-Carpathians – Sarmatian; Russia: Moldavia – Middle Sarmatian; Ukraine: Volhyn-Podolian Platform, Transcarpathians – Middle Sarmatian; Hungary: Zsámbék Basin – Sarmatian, lower most part of the, *Spirolina austriaca* zone.

Bolivina sarmatica DIDKOWSKI, 1959
(Pl. IX, fig. 5)

1961. *Bolivina aff. sarmatika* DIDKOWSKI; CICHA et ZAPLETALOVÁ, p. 152, Abb. 25.
1970. *Bolivina sarmatica* DIDKOWSKI; DIDKOWSKI et SATANOVSKAJA, p. 144, Tabl. 82, fig. 9.
1975. *Bolivina sarmatica* DIDKOWSKI; VENGLINSKI, p. 201, Tabl. XV, fig. 1-4.

Material. Over 100 specimens.

Description. Test small, elongated, flattened; periphery subrounded; biserial throughout; the number of chambers twenty-twenty two; proloculus small; in early stage the chambers are small, low and strongly increasing in size; later chambers low, broad and nearly uniform in width; the last two chambers large, about double size than the previous, nearly spherical in shape; sutures distinct, slightly depressed and somewhat curved towards the apertural end of the test; there is an angle of 60-80° between the sutures and the longitudinal axe of the test; wall hyaline, finely perforate; surface covared with small, imperforate costae expect the last two chambers, which ornamented with short and deep, wavy wrinkles; aperture a broad and low loop at the apertural face.

Dimensions. Length: 0.2-0.34 mm; breadth: 0.09-0.13 mm.

Variability. The angel between the suture and the axe of the test varies from acute angle (60°) to nearly perpendicular.

Distribution. West-Carpathians – Sarmatian; Russia: Moldavia – Middle Sarmatian; Ukraine: Transcarpathians, Precarpathians, Volhyn-Podolian Platform – Middle Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Superfamily Cassidulinacea D'ORBIGNY, 1839
Family Cassidulinidae D'ORBIGNY, 1839
Subfamily Cassidulininae D'ORBIGNY, 1839
Genus Cassidulina D'ORBIGNY, 1826

Cassidulina margareta KARRER, 1877
(Pl. IX, fig. 6-7)

1877. *Cassidulina Margareta* KARRER; KARRER, p. 386, Taf. XVI, Fig. 52.

1958. *Cassidulina margareta* KARRER; VENGLINSKI, p. 155, Tabl. XXXIV, fig. 3.
1962. *Cassidulina margareta* KARRER; VENGLINSKI, p. 155, Tabl. XVIII, fig. 1.
1970. *Cassidulina margareta* KARRER; DIDKOWSKI et SATANOVSKAJA, p. 1 41, Tabl. 81, fig. 4.

Material. About 50 specimens.

Description. Test nearly circular, flattened, small; periphery subrounded or subacute; chambers biserially arranged and plane of the biseriality planispirally enrolled, for this reason four large diagonally arranged chambers and at their contacts four small chambers are visible on both side of the test; chambers inflated; sutures depressed, distinct; wall thin, perforate; surface smooth, polished; aperture elongate, slit-like, deepen, placed near and parallel to the peripheral margin.

Dimensions. Length: 0.16-0.21 mm; breadth: 0.14-0.2 mm; thickness: 0.04-0.08 mm.

Variability. The chambers may be more or less inflated.

Remarks. This species is easily distinguished from the other *Cassidulina* species by the less number of chambers and lacking of umbonal boss.

Distribution. Austria: Baden, Vöslau – Miocene; Ukraine: Transcarpathians – Badenian, Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Superfamily Buliminacea JONES, 1875
Family Buliminiadae JONES, 1875
Genus Bulimina D'ORBIGNY, 1826

Bulimina elongata (D'ORBIGNY, 1826)
(Pl. IX, fig. 8)

1846. *Bulimina elongata* D'ORBIGNY; D'ORBIGNY, p. 187, Taf. 11, Fig. 19, 20.
1951. *Bulimina elongata* D'ORBIGNY; MARKS, p. 57, pl. 7, fig.12.
1958. *Bulimina elongata* D'ORBIGNY; VENGLINSKI, p. 132, Tabl. XXIX, fig. 1, 2. Tabl. XXVIII, fig. 3-6.

1968. *Bulimina elongata* D'ORBIGNY; KORECZ-LAKY, p. 89, Taf. V, Fig. 3.
1970. *Bulimina elongata elongata* D'ORBIGNY; DIDKOWSKI et SATANOVSKAJA, p. 129, Tabl, 77, fig. 2.
1973. *Bulimina elongata* D'ORBIGNY; KORECZ-LAKY, Pl. VII, fig. 6.
1985. *Bulimina elongata* D'ORBIGNY; PAPP et SCHMID, p. 73, Pl. 63, figs. 5-9.
1991. *Bulimina elongata* D'ORBIGNY; CIMERMAN and LANGER, p. 62, pl. 64, figs. 3-8.

Material. 18 specimens.

Description. Test elongated, triserial; chambers, inflated, size increase gradually; sutures depressed, distinct, curved and oblique; there is an angle of 30-45° between the sutures and the logitudinal axe of the test; wall calcareous, semi-transparent and finely perforate; surface smooth; aperture a long loop at the apertural face of the last chamber, boardering with a narrow and raised rim and provided with a toothplate.

Dimensions. Length: 0.3-0.55 mm; breadth: 0.15-0.2 mm.

Variability. Often the later chambers are in uniserail arrengement.

Remarks. The longitudinal axe of the test is often curved. Sometimes spines and nodes appeare on the oldest chambers of the test.

Distribution. Oligocene – Recent. Recently lives between 70 - 2500 m (DIDKOWSKI et SATANOVSKAJA, 1970). Austria: Vienna Basin – Carpathian, Badenian; Ukraine: Transcarpathians – Upper Badenian, Lower and Middle Sarmatian; Hungary: Mecsek Mts., Tokaj Mts. – Badenian, Zsámbék Basin – Sarmatian.

Family Buliminaellidae HOFKER, 1951
Genus Buliminella CUSHMAN, 1911

Buliminella elegantissima (D'ORBIGNY, 1839)
(Pl. XI, figs. 9-10)

1839. *Bulimina elegantissima* D'ORBIGNY; D'ORBIGNY, p. 51, Taf. 5.
1970. *Buliminella elegantissima* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 127, Tabl. 76, fig. 2.

Material. 36 specimens.

Description. Test elongated, small; only two whorls in a high trochospiral coil; numerous chambers low and very broad; intercameral sutures slightly depressed, distinct, slightly curved; spiral suture despressed, distinct; wall perforate, thin; surface smooth; aperture elongate, drop-shape, the boardest at the upper end, strongly deepen in the final chamber.

Dimensions. Length: 0.25-0.32 mm; diameter: 0.09-0.11 mm.

Remarks. In our material no specimens were found with three whorls as figured D'ORBIGNY, 1839.

Distribution. d'Orbigny desribed from Cuba, recent. Frequent in Oligocene and Miocene. some desriptions from Sarmatian: Ukraine: Black Sea Depression – Middle Sarmatian; Russia: Moldavia – Middle Sarmatian; Hungary: Zsámbék Basin – Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone. Occuranced together with *Bulimina, Bolivina* and *Caucasina* species.

Superfamily Fursenkoinacea LOEBLICH and TAPPAN, 1961
Family Fursenkoinidae LOEBLICH and TAPPAN, 1961
Genus Fursenkoina LOEBLICH and TAPPAN, 1961

Fursenkoina acuta (D'ORBIGNY, 1846)
(Pl. IX, figs. 11-12)

1846. *Polymorphina acuta* D'ORBIGNY; D'ORBIGNY, p. 234, Taf. 13, Fig. 4, 5; Taf. 14, Fig. 5-7.
1848. *Virgulina Schreibersii* CZJZEK; CZJZEK, p. 147, Taf. XIII. Fig. 18-21.
1951. *Virgulina schreibersiana* CZJZEK; MARKS, p. 59.
1958. *Virgulina schreibersiana* CZJZEK; VENGLINSKI, p. 136, Tabl. XXIX, fig. 10.
1968. *Virgulina schreibersiana* CZJZEK; KORECZ-LAKY, p. 101, Taf. V, fig. 4.
1970. *Virgulina schreibersiana* CZJZEK; DIDKOWSKI et SATANOVSKAJA, p. 128, Tabl. 76, fig. 9.
1973. *Virgulina schreibersiana* CZJZEK; KORECZ-LAKY, Pl. VII, fig. 7.
1985. *Virgulina acuta* (D'ORBIGNY); PAPP et SCHMID, p. 82, Pl. 75, figs. 1-6.
1991. *Virgulina acuta* (D'ORBIGNY); CIMERMAN and LANGER, p. 64, pl. 67, figs. 1-2.

Material. 25 specimens.

Description. Test elongeted, slightly flattened, periphery subrounded; biserial; chambers elongated, slightly inflated; sutures oblique, depressed; wall hyaline, very thin, finely perforate; surface smooth; aperture narrow, elongated, with a denticulate toothplate.

Dimensions. Length: 0.3-0,55 mm; breadth: 0.1-0.16 mm.

Variability. The test may be somewhat curved.

Remarks. The difference between the descriptions of *Polymorphina acuta* D'ORBIGNY, 1846, and of *Virgulina Schreibersii* CZJZEK, 1848, lies in the radiate aperture in the first and comma-shaped aperture in the latter species. According to the revision of D'ORBIGNY, 1846, in PAPP et SCHMID, 1985, the illustrations of D'ORBIGNY fit only a few juvenile specimens, and the typical aperture shape is the same as *Virgulina Schreibersii* CZJZEK. This species differs from *V. sarmatica* VENGLINSKI, 1958 in its slenderer test shape and larger dimensions.

Distribution. Paleogene – Recent, cosmopolitan in warm shallow seas. Austria: Baden, Möllersdorf – Miocene; Ukraine: Transcarpathians – Badenian; Hungary: Mecsek Mts. and Tokaj Mts. – Badenian, Zsámbék Basin – Sarmatian, *Elphidium reginum* zone.

Superfamily Delosinacea PARR, 1950,
Family Caucasinidae N. K. BYKOVA, 1950
Subfamily Caucasininae N. K. BYKOVA, 1959
Genus Caucasina KHALILOV, 1951

Caucasina schichkinskye (SAMOYLOVA, 1947)
(Pl. IX, fig. 13, Pl. X, fig. 1)

1951. *Bulimina elongata* D'ORBIGNY var subulata CUSHMAN et PARKER; MARKS, p. 57, Pl. 7, fig. 13.
1951. *Bulimina elongata* D'ORBIGNY var. lappa CUSHMAN et PARKER; MARKS, p. 57, Pl. 7, fig. 14.
1958. *Caucasina schischkinskye* SAMOYLOVA; VENGLINSKI, p. 135, Tabl. XXIX, fig. 4-9.
1962. *Caucasina lalova* VENGLINSKI; VENGLINSKI, p. 109, Tabl. 17, fig 4

1970. *Caucasina lalovi* VENGLINSKI; DIDKOWSKI et SATANOVSKAJA, p. 134, Tabl. 79, fig. 1.
1975. *Caucasina khalilovi* LOEBLICH et TAPPAN sarmatica VENGLINSKI; VENGLINSKI, p. 193, Tabl. XXXI, fig. 6-38.
1975. *Caucasina subaculeata* VENGLINSKI; VENGLINSKI, p. 194, Tabl. XXXI, fig. 1-5.

Material. 54 specimens.

Description. Test elongate, nearly circular in cross-section; base bluntly rounded; oblique cutted at the aperture; initial portion low trochospiral, only one or two whorls, five or six chambers per whorl; later chamberrs triserial, inflated, nearly spherical, size increase continously; sutures depressed, distinct and curved; the sutures between the whorls nearly at right angle to the longitudinal axe of the test; wall thin, semitransparent and finely perforated; surface smooth or may be covered by short spines and, or nodes on the basal part of the early chambers; aperture narrow and elongated loop, surrounding by a narrow and raised rim, with a broad toothplate.

Dimensions. Length: 0.24-0.43 mm; diameter: 0.12-0.2 mm.

Variability. The shape of the test may be subcylindrical, gradually increase in cross-section or nearly spherical. The specimens occasionally bear spines and nodes on the basal of the test.

Remarks. In our material the spines and the nodes appeared frequently on the small, squat specimens. Presence or lack of the spines is not a characteristic feature.

The text of the descriptions of *Caucasina schischkinskye* SAMOYLOVA in VENGLINSKI, 1958 is the same as *Caucasina subaculeata* VENGLINSKI in VENGLINSKI, 1975, the only difference is that the spines are always present on the latter species. *Caucasina khalilovi* LOEBLICH et TAPPAN sarmatica VENGLINSKI, 1975, differs from the *Caucasina subaculeata* VENGLINSKI, 1975, in the lack of spines and the somewhat larger test. The size of the test is in the range given for *Caucasina schischkinskye* SAMOYLOVA.

In Mány-17. borehole, between 141.1-143,3 meters in *E. hauerinum* zone there are many degenerate, specimens, with bifurcated test bearing two aperture similarly as figured by VENGLINSKI, 1975, on plate XXXI, figure 31a. According to BOLTOSKOY (1976) it is in connection with the regenerating of mechanical damages.

Distribution. Oligocen – Miocene. Ukraine: Transcarpathians – Upper Badenian Sarmatian; Hungary: Zsámbék Basin – Sarmatian. Common in *E.*

hauerinum zone and in Ukraine, Eastern Paratethys in *Bolivina sarmatica* zone (VENGLINSKI, 1975).

Superfamily Discorbacea EHRENBERG, 1838
Family Rosalinidae REISS, 1963
Genus Rosalina D'ORBIGNY, 1826

Rosalina obtusa D'ORBIGNY, 1846
(Pl. X, figs. 2-4)

1846. *Rosalina obtusa* D'ORBIGNY; D'ORBIGNY, p. 179, Taf. 11, Fig. 4-6.
1951. *Discorbis obtusus* (D'ORBIGNY); MARKS, p. 63.
pars 1958. *Discorbis obtusum* (D'ORBIGNY); VENGLINSKI, p. 148. Tabl. 32, fig. 1, 2, 3.
1968. *Discorbis obtusa* (D'ORBIGNY); KORECZ-LAKY, p. 107, Taf. 6, Fig. 13-14.
non 1970. *Discorbis obtusum* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 80, Tabl. 51, fig. 7.
1975. *Discorbis obtusum* (D'ORBIGNY); VENGLINSKI, p. 177, Tabl. 24, fig. 1, 2.
1985. *Rosalina obtusa* D'ORBIGNY; PAPP et SCHMID, p. 67, Pl. 61, figs. 7-12.

Material. 48 specimens.

Description. Test trochospiral, nearly circular to broadly oval, flattened with slightly convex dorsal face and more or less concave ventral face; periphery subacute; on the spiral side are two whorls; inner whorl consists of four to six small chambers, wich indistict in the adult specimens; on the outer whorl and on the umbilical side are four to six chambers; size of chambers increases rapidly, the last chamber occupying one-third of the whorl; sutures slightly depressed and curved back at the periphery – on the dorsal side, strongly depressed and nearly straight on the ventral side; wall thin, distinctly perforate on the spiral side, gently or not perforate on the umbilical side; surface smooth, often granulated in the umbilicus; aperture long arch on the umbilical side, broader at the umbilicus and narrower at the periphery of the test.

Dimensions. Maximum diamter: 0.2-0.5 mm; thickness: 0.18-0.3 mm.

Variability. The shape of the test is variable, depends on the size and shape of the last chamber. The ventral side may be perforate or unperforate, with or without granules in the umbilicus.

Remarks. The plate XXXII, fig.1. in VENGLINSKI (1958) is the same as the plate 51, fig. 7. in DIDKOWSKI et SATANOVSKAJA (1970). These specimens differs from *Rosalina obtusa* D'ORBIGNY in their smallest test size, more chambers (nine) on the ventral side and broad, irregular and keeled edge on the periphery of the test.

Distribution. Austria: Nussdorf, Ukraine: Transcarpathians – Upper Badenian – Lower Sarmatian; Hungary: Mecsek Mts. – Upper Badenian, Zsámbék Basin – Sarmatian.

Superfamily Glabratellacea LOEBLICH and TAPPAN, 1964
Family Glabratellidae LOEBLICH and TAPPAN, 1964
Genus Schackoinella WEINHANDL, 1958

Schackoinella imperatoria (D'ORBIGNY, 1846)
(Pl. X, figs. 5-6)

1846. *Rosalia imperatora* D'ORBIGNY; D'ORBIGNY, p. 176, Taf. 10, Fig. 16-18.
1877. *Calcarina Carpenteri* KARRER; KARRER, p. 387. Taf. XVI, Fig. 58.
1958. *Discorbis imperatorius* (D'ORBIGNY); VENGLINSKI, p. 146, Tabl. 31. fig. 5.
1964. *Discorbis imperatorius* (D'ORBIGNY); KORECZ-LAKY, Taf. I, Fig. 11.
1967. *Glabratella plana* LUCZKOWSKA; LUCZKOWSKA, p. 237, Pl. VIII, fig. 13-15.
1970. *Discorbis imperatorius* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 79, Tabl. 51, fig. 3.
1973. *Discorbis imperatorius* (D'ORBIGNY); KORECZ-LAKY, Pl.I, fig. 2.
1974. *Glabratella imperatoria* (D'ORBIGNY); BRESTENSKÁ, p. 258, Taf. 4, Fig. 1-3.
1985. *Schackoinella imperatoria* (D'ORBIGNY); PAPP et SCHMID, p. 66, Pl. 60, figs. 1-5.
1991. *Conorbella imperatoria* (D'ORBIGNY); CIMERMAN and LANGER, p. 68, pl. 72, figs. 9-11.

Material. 5 specimens.

Description. Test small, trochospiral; nearly circular in outline; dorsal and ventral side are convex; on the spiral side are two or two and half whorls; the inner whorl consists of four to six chambers, on the last whorl and on the umbilical side are four to seven chambers; on the dorsal side each rapidly enlarging chamber bears a long pointed spine forming a stellate outline of the test; imbilicus strongly deepen on the ventral side; sutures somewhat depressed, indistinct and slightly inflected on the dorsal side, depressed and radiate on the ventral side; wall smooth and finely perforate ont he dorsal side; surface on the ventral is ornamented with striae radiating from the imbilicius and with separating rows of fine granules; aperture an interiomaginal umbilical slit.

Dimensions. Diameter: 0.23-0.32 mm.

Variability and ontogeny. The dimorfism appear in the shape of the test. The schizont form differs from the gamont form in its more flattened stellate outline, the radially elongated chambers and the horizontal spines as *Calcarian Carpenteri* KARRER, 1877 and *Glabratella plana* LUCZKOWSKA, 1967.

Distribution. Miocene to Recent, recently lives Mediterranean Sea (CIMERMAN and LANGER, 1991). Poland: Tarnopol and Holubica in Galicia - Lower Sarmatian, Holy Cross Mts. - Lower Sarmatian; Ukraine. Transcarpathians - Upper Badenian to Lower Sarmatian; Hungary: Tokaj Mts., Zsámbék Basin - Sarmatian, *Elphidium reginum* zone.

Superfamily Planorbulinacea SCHWAGER, 1877
Family Cibicididae CUSHMAN, 1927
Subfamily Cibicidinae CUSHMAN, 1927
Genus Cibicides de MONFORT, 1808

Cibicides lobatulus (WALKER et JACOB, 1798)
(Pl. X, figs. 7-8)

1846. *Truncatulina lobatula* D'ORBIGNY; D'ORBIGNY, p. 168, Taf. 9, Fig. 18-23.
1846. *Anomalina variolata* D'ORBIGNY; D'ORBIGNY, p. 170, Taf. 9, Fig. 27-29.
1951. *Cibicides lobatulus* (WALKER et JACOB); MARKS, p. 73.
1961. *Cibicides lobatulus* (WALKER et JACOB); DUPEUBLE, p. 197, Pl. 1, fig. 1.
1962. *Cibicides lobatulus* (WALKER et JACOB); VENGLINSKI, Tabl. 13, fig. 3.

1964. *Cibicides lobatulus* (WALKER et JACOB); KORECZ-LAKY, Taf. III, Fig. 1.
1968. *Cibicides lobatulus* (WALKER et JACOB); KORECZ-LAKY, p. 122, Taf. IX, Fig. 16.
1970. *Cibicides lobatulus* (WALKER et JACOB); DIDKOWSKI et SATANOVSKAJA, p. 93, Tabl. 60, fig. 1.
1973. *Cibicides lobatulus* (WALKER et JACOB); KORECZ-LAKY, Pl. I, fig. 10.
1973. *Cibicides datensis* FUJITA-ITO; KORECZ-LAKY, Pl. I, fig. 11.
1974. *Cibicides lobatulus* (WALKER et JACOB); BRESTENSKÁ, p. 273, Taf. 4, Fig. 5.
1975. *Cibicides variolatus* (D'ORBIGNY); VENGLINSKI, p. 180. Tabl. 25, fig. 2, 5.
1985. *Cibicides lobatulus* (WALKER et JACOB); PAPP et SCHMID, p. 64, 65, Pl. 56, figs. 1-5, Pl. 57, figs. 1-3.
1991. *Lobatula lobatula* (WALKER et JACOB); CIMERMAN and LANGER, p. 71, pl. 75, figs. 1-4.

Material. Over 1000 speciemens.

Description. Test large, trochospiral, variable in shape; periphery carinate, often irregular; dorsal side evolute, convex, six to eight chambers visible; ventral side involute, plan or convex depending on the substrata, seven to twelve chambers visible; sutures strongly depressed and slightly cuved on the spiral side, depressed and strongly bent back at the periphery on the umbilical side; wall optically radial, dorsal side coarsely perforate, ventral side finely perforate, sutures and peripherical keel imperforate; surface smooth; aperture a low interiomarginal, equatorial arch, somewhat extending onto the spiral side, surrounded with an imperforate, narrow rim.

Dimensions. Maximum diameter of the test: 0.4-1.4 mm.

Variability. As this species lives attached to the substrate the shape of the test is variable.

Distribution. Neogene – Recent, cosmopoliten. Austria: Vienna Basin (Nussdorf) – Badenian and Sarmatian; Ukraine: Transcarpathians – Badenian and Lower Sarmatian; Czecho-Slovakia – Sarmatian; Hungary: Mecsek Mts., Tokaj Mts. – Badenian and Lower Sarmatian, Zsámbék Basin – Sarmatian.

Very common in the Lower Sarmatian, *Elphidium reginum* zone.

Superfamily Rotaliacea EHRENBERG, 1839
Family Nonionidae SCHULTZE, 1854
Subfamily Nonioninae SCHULTZE, 1854
Genus Nonion de MONFORT, 1808

Nonion bogdanowiczi VOLOSHINOVA, 1952
(Pl. XI, fig. 4)

1952. *Nonion bogdanowiczi* VOLOSHINOVA; VOLOSHINOVA, p. 19, Tabl. I, fig. 7-8.
non 1958. *Nonion bogdanowiczi* VOLOSHINOVA; VENGLINSKI, p. 108, Tabl. 21, fig. 4.
1960. *Nonion bogdanowiczi* VOLOSHINOVA; STANCHEVA, p. 16, Tabl. III, fig. 4.
non 1970. *Nonion bogdanowiczi* VOLOSHINOVA; DIDKOWSKI et SATANOVSKAJA, p. 96, Tabl. 62, fig. 4.
1973. *Nonion bogdanowiczi* VOLOSHINOVA; KORECZ-LAKY, p. V, fig. 8.
1974. *Florilus bogdanowiczi* (VOLOSHINOVA); BRESTENSKÁ, p. 267, Taf. 8, Fig. 3.

Material. Over 500 speciemens.

Description. Test small, nearly rounded or slightly oval, compressed and biumbilicate; planispirally coiled, involute; periphery rounded; six to nine chambers visible from the outside; chambers somewhat inflated, rapidly increasing in size; sutures distinct, slightly curved back; flat or slightly depressed at the periphery and deepen and broaden towards the umbilicus; umbilicus somewhat depressed or flat; wall thin, finely perforate; surface smooth except the umbilicus and central part of sutures, wich completely filled with fine granules; aperture a low interiomarginal arch at the base of the aperural face.

Dimensions. Diameter: 0.17-0.32 mm; thickness: 0.05-0.13 mm.

Variability. The characteristic featues of this species are rapidly enlarging chambers and the ornamented umbilicus and central part of the sutures.

Remarks. Our specimens can be well indentified with the type described and figured by VOLOSHINOVA, 1952. The specimens described and illustrated by VENGLINSKI (1958) and DIDKOWSKI et SATANOVSKAJA (1970) differ from it in having slightly evolute test, more chambers in the final whorl and the size of the chambers increases gradually.

Distribution. Russia (Crime, Caucasus) and Ukraine East-Precaucasus – Lower and Middle SArmatian; North-Western Bulgaira – Lower and Middle Sarmatian. Czecho-Slovakia – Lower Sarmatian; Hungary: Tokaj Mts. – Lower Sarmatian, Zsámbék Basin – Sarmatian.

Genus Porosononion PUTRYA, in VOLOSHINOVA, 1958

Porosononion granosum (D'ORBIGNY, 1826)
(Pl. XI, fig. 5)

1846. *Nonionina perforata* D'ORBIGNY; D'ORBIGNY, p. 110, Taf. 5, Fig. 17, 18.
1846. *Nonionina granosa* D'ORBIGNY; IBIDEM, p. 110, Taf. 5, Fig. 19, 20.
1846. *Nonionina punctata* D'ORBIGNY; IBIDEM, p. 111, Taf. 5, Fig. 21, 22.
1951. *Nonion granosum* (D'ORBIGNY); MARKS, p. 48.
1951. *Nonion perforatum* (D'ORBIGNY); MARKS, p. 48, Pl. 6, fig. 4.
1952. *Nonion granosus* (D'ORBIGNY); VOLOSHINOVA, p. 20, Tabl. 1, fig. 6.
1958. *Nonion granosus* (D'ORBIGNY); VENGLINSKI, p. 105, Tabl. XXI, fig. 3.
1964. *Nonion granosum* (D'ORBIGNY); KORECZ-LAKY, p. 479, Taf. I, Fig. 8.
1968 *Nonion granosum* (D'ORBIGNY); KORECZ-LAKY, p. 89, Taf. 1, Fig. 6.
1970. *Nonion granosus* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 97, Tabl. 62, fig. 5.
1973. *Nonion granosum* (D'ORBIGNY); KORECZ-LAKY, Pl. IV, fig. 13.
1974. *Protelphidium ex. gr. granosum* (D'ORBIGNY); BRESTENSKÁ, p. 263, Taf. 8, Fig. 4.
1982. *Nonion granosum* (D'ORBIGNY); KORECZ-LAKY, p. 166, fig. 1-3.
1985. *Elphidium (Porosononion) granosum* (D'ORGIBNY); PAPP et SCHMID, p. 46-47, Pl. 36, figs. 6-8, Pl. 37, figs. 1-9, text-plate 6.

Material. Over 5000 specimens.

Description. Test circular, compressed and biumbilicate, planispirally enrolled, involute; periphery rounded nine to twelve slightly inflated chambers visible in the final whorl, gradually increasing in size sutures depressed and slightly bent umbilicus wide and more or less flat, with umbilical spiral canal system no ponticuli, septal canals and sutural pores wall relatively thick, distinctly perforate surface smooth except the umbilical area, which covered with numerous warts aperture multiple, interiomarginal, placed at the base of the apertural face.

Dimensions. Diameter: 0.2-0.5 mm thickness: 0.11-0.26 mm.

Variability. The umbilicus may be more less wide and its ornamentation may be stronger or weaker. The size of the pores of wall is variable.

Remarks. We accept the conclusion os PAPP et SCHMID (1985),that *Nonionina perforata* D'ORBIGNY, 1846 and *Nonionina punctata* D'ORBIGNY, 1846 are synonymous with *Nonionina granosa* D'ORBIGNY, 1846.

Distribution. Miocene to Recent. In Paratethys widely distributed, especially typical int he early Sarmatian, in *"Nonion" granosum* zone. Zsámbék Basin – abundant in Sarmatian.

Family Trichohyalidae SAIDOVA, 1981
Genus Aubignyna MARGEREL, 1970

Aubinyna simplex (D'ORBIGNY, 1846)
(Pl. X, figs. 9-12)

? 1846. *Rosalina simplex* D'ORBIGNY; D'ORBIGNY, p. 178, pl. 10, Fig. 25-27.
1958. *Rotalia simplex* (D'ORBIGNY); VENGLINSKI, p. 152, Tabl. XXXIII, fig. 3.
1970. *Rotalia simplex* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 113, Tabl. 69, fig. 3.
? 1985. *Anomalina badenensis* (D'ORBIGNY); PAPP et SCHMID, p. 67, Pl. 61, fig. 6.
1991. *Aubignyna planidorso* (ATKINSON); CIMERMAN and LANGER, p. 75, pl. 86, figs. 5-6.

Material. About 60 specimens.

Description. Test small, broad-oval, low trochospiral coil of two or two and half whorls; periphery broadly rounded; nine to eleven chambers are on the slightly convex to plan spiral side; five to seven chambers visible on the ventral side; size of slightly inflated chambers increases gradually; sutures more or less depressed, slightly curved back on the dorsal side; on the ventral side umbilicus deepen, surrounded by radial, sutural fissures, which continue as slightly depressed sutures towards the periphery of the test; wall thin, finely perforate; surface smooth, except for the finely granulated umbilicus and the sutural fissures; aperture an interiomarginal narrow arch, extending from the periphery to the umbilicus.

Dimensions. Maximum diameter of the test: 0.24-0.34 mm.

Variability. The inner whorl may be more or less elevated.

Remarks. The specimens from Zsámbék Basin can be well identified with the description and figuration of VENGLINSKI, 1958 and with *Aubignyna planidorso* (ATKINSON) in CIMERMAN and LANGER, 1991.

According to the revision of the original material of D'ORBIGNY published by PAPP et SCHMID (1985) *Rosalina simplex* D'ORBIGNY, 1846 should be synonymous with *Anomalina badenensis* (D'ORBIGNY, 1846). *Anomalina badenensis* (D'ORBIGNY) differs from *Rosalina simplex* D'ORBIGNY, in its larger size of the test, inner whorl usually invisible, or depressed, the surface coarsely perforate and the sutures slightly curved on the umbilical side.

Distribution. Badenian to Recent. Ukraina Transcarpathians – Upper Badenian, Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Family Rotaliidae EHRENBERG, 1839
Subfamily Ammoniinae SAIDOVA, 1981
Genus Ammonia BRÜNNICH, 1772

Ammonia beccarii (LINNÉ, 1758)
(Pl. XI, figs. 1-3)

1846. *Rosalina viennensis* D'ORBIGNY; D'ORBGINY, p. 177, Taf. 10, Fig. 22-24.
1958. *Rotalia beccarii* (LINNÉ); VENGLINSKI, p. 151, Tabl. 33, fig. 1, 2.
1963. *Ammonia beccarii* (LINNÉ); PAPP, p. 281, Taf. 14.
1964. *Rotalia beccarii* (LINNÉ); KORECZ-LAKY, Taf. 1, Fig. 9.
1968. *Rotalia beccarii* (LINNÉ); KORECZ-LAKY, p. 109, Taf. V, fig. 18.
1970. *Streblus beccarii* (LINNÉ); DIDKOWSKI et SATANOVSKAJA, p. 113, Tabl. 69, fig. 5.
1973. *Rotalia beccarii* (LINNÉ); KORECZ-LAKY, Pl. V, fig. 10.
1974. *Ammonia ex. gr. beccarii* (LINNAEUS); BRESTENSKÁ, p. 259, Taf. 3, Fig. 3, 4.
1975. *Ammonia beccarii* (LINNÉ); VENGLINSKI, p. 190. Tabl. 29, fig. 5, Tabl. 30, fig. 1, 3, 4.
1984. *Ammonia beccarii* (LINNÉ); LÉVY et al., p. 382, Pl. 1, fig. 4, 7-8, 12.
1985. *Ammonia beccarii* (LINNÉ); PAPP et SCHMID, p. 67, Pl. 61, figs. 1-5.
1991. *Ammonia beccarii* (LINNAEUS); CIMERMAN and LANGER, p. 76, pl. 87, figs. 3-4.

Material. Over 5000 specimens.

Description. Test round, trochospiral coil of two and half to four whorls; periphery rounded to subrounded; ten to twenty chambers are on the more or less convex spiral side; on the ventral side only the chambers of the last whorl are visible; size of slightly inflated chambers increases continously; sutures distinct, sometimes somewhat elevated and curved back on the dorsal side; on the ventral side umbilicus deepen, open and may have an umbilicus plug surrounded by radial, deeply incised, nearly straight sutural fissures; often bordered by folium from each chambers of the final whorl; wall thin, finely perforate; surface smooth, except for the more or less granulated umbilicus and sutural fissures; aperture an interiomarginal slit extending under the folium of chambers.

Dimensions. Diameter: 0.2-0.45 mm.

Variability. The size of the test and the intensity of the ornamentation in the umbilicus are variable, dependent on ecological factors. Variability is discussed in detail in PAPP (1963) and VÉNEC-PEYRÉ (1983).

Remarks. There are lot of degenerate specimens, with large irregularly coiled last chambers, or nearly flat or slightly depressed, spiral side (Pl. XI, fig.3), in the *Elphidium hauerinum* zone.

Distribution. Miocene - Recent. Widely distributed in Badenian and Sarmatian in Paratethys. Hungary: Zsámbék Basin – abundant in Sarmatian.

Family Elphidiidae GALLOWAY, 1933
Subfamily Elphidiinae GALLOWAY, 1933
Genus Elphidium MONFORT, 1808

Elphidium aculeatum (D'ORBGINY, 1846)
(Pl. XI, figs. 6-7)

1846. *Polystomella Josephina* D'ORBIGNY; D'ORBIGNY, p. 130, Taf. 6. Fig. 25-26.
1846. *Polystomella aculeata* D'ORBGINY; D'ORBIGNY, p. 131, Taf. 6, Fig. 27-28.
1951. *Elphidium aculeatum* (D'ORBGINY); MARKS, p. 50, Pl. 6, fig. 11.
1951. *Elphidium josephinum* (D'ORBIGNY); MARKS, p. 52.
1952. *Elphidium josephina* (D'ORBGINY); VOLOSHINOVA, p. 40, Tabl. IV, fig. 3.

1952. *Elphidium aculeatum* (D'ORBIGNY); VOLOSHINOVA, p. 41, Tabl. IV, fig. 2, 4, 6.
1958. *Elphidium josephinum* (D'ORBIGNY); VENGLINSKI, p. 112, Tabl. XXIII, fig. 3.
1958. *Elphidium aculeatum* (D'ORBIGNY); VENGLINSKI, p. 120, Tabl. XXII, fig. 3.
1960. *Elphidium aculeatum* (D'ORBIGNY); STANCHEVA, p. 18, Tabl. III, fig. 2.
1960. *Elphidium josephinum* (D'ORBIGNY); STANCHEVA, p. 19, Tabl. III, fig. 8.
1963. *Elphidium aculeatum aculeatum* (D'ORBIGNY); PAPP, p. 274, Taf. 11, Fig. 7.
1963. *Elphidium josephinum* (D'ORBIGNY); PAPP, p. 274, Taf. 11, Fig. 6.
1964. *Elphidium aculeatum* (D'ORBIGNY); KORECZ-LAKY, p. 479, Taf. I, Fig. 3.
1964. *Elphidium josephinum* (D'ORBIGNY); KORECZ-LAKY, p. 355, Taf. I, Fig. 6.
1968. *Elphidium aculeatum* (D'ORBIGNY); KORECZ-LAKY, p. 90, Taf. I, Fig. 11.
1970. *Elphidium aculeatum* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 144, Tabl. 70, fig. 1.
1970. *Elphidium josephina* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 120, Tabl. 71, fig. 7.
1973. *Elphidium josephinum* (D'ORBIGNY); KORECZ-LAKY, Taf. IV, fig. 1.
1973. *Elphidium aculeatum* (D'ORBIGNY); KORECZ-LAKY, pl. IV, fig. 14.
1974. *Elphidium aculeatum* (D'ORBIGNY); BRESTENSKÁ, p. 259, Taf. 5, Fig. 1.
1974. *Elphidium josephinum* (D'ORBIGNY); BRESTENSKÁ, p. 259, Taf. 5, Fig. 3.
1982. *Elphidium aculeatum* (D'ORBIGNY); KORECZ-LAKY, pl. I, fig. 1, 2.
1985. *Elphidium aculeatum* (D'ORBIGNY); PAPP et SCHMID, p. 52, Pl. 43, figs. 1-7.
1991. *Elphidium aculeatum* (D'ORBIGNY); CIMERMAN and LANGER, p. 77, pl. 89, figs. 1-4.

Material. Over 500 specimens.

Description. Test planispirally enrolled, involute, nearly circular in outline, flattened; periphery angled; eleven or twelve chambes are in the final whorl, slowly increasing in size in the adult stage; sutures distinct, depressed; septa gently curved and terminating in spines; ponticuli long and narrow, eight to twelve on each chambers; fossettes granulated; umbilicus slightly depressed; wall optically radial; aperture, row of foramina at the base of low septal face.

Dimensions. Diameter: 0.4-1.0 mm; thickness: 0.16-0.32 mm.

Variability. The size of the spines is variable.

Remarks. We accept the discussion of PAPP et SCHMID (1985), that *E. josephinum* is the juvenile stage of *E. aculeatum.*

Distribution. Characteristic species of Paratethys during the Sarmatian, particularly common in the Lower Sarmatian, in the *Elphidium reginum* zone (PAPP et SCHMID, 1985).

Elphidium crispum (LINNÉ, 1758)
(Pl. XI, figs. 8-9)

1846. *Polystomella crispa* D'ORBIGNY; D'ORBIGNY, p. 125, Taf, 6, Fig. 9-14.
1951. *Elphidium crispum* (LINNÉ); MARKS, p. 51.
1958. *Elphidium crispum* (LINNÉ); VENGLINSKI, p. 115, Tabl. XXV, fig. 2, 6.
1963. *Elphidium crispum* (LINNÉ); PAPP, p. 264, Taf. 7, Fig. 2, Taf. 8, Fig. 1-5.
1964. *Elphidium crispum* (LINNÉ); KORECZ-LAKY, p. 478. Taf, 5, Fig. 1.
1968. *Elphidium crispum* (LINNÉ); KORECZ-LAKY, p. 90, Taf. V, Fig. 15.
1970. *Elphidium crispum* (LINNÉ); DIDKOWSKI et SATANOVSKAJA, p. 116, Tabl. 71, fig. 1.
1985. *Elphidium crispum* (LINNÉ); PAPP et SCHMID, p. 50, Pl. 40, figs. 5-8.
1991. *Elphidium crispum* (LINNAEUS); CIMERMAN and LANGER, p. 77, pl. 90, figs. 1-6.

Material. Over 100 specimens.

Description. Test planispiral, large, lenticular, rhombic in cross-section; periphery carinate; fourteen to thirty slender chambers visible from the exterior; sutures distinct, depressed and curved; ponticuli narrow and long, eight to twelve on each chamber; fossettes granulated; umbilicus elevated, forming an umbilical plug, ornamented with nine to twelve small pits; wall optically radial; aperture row, of foramina at the base of septal face.

Dimensions. Diameter: 0.6-1.2 mm; thickness: 0.16-0.32 mm.

Variability. The umbilicus may be more or less ornamented.

Remarks. The characteristic feature of this species is the rhombic cross-section of the test and the ornamented umbilical plug.

Distribution. Paleogene to Recent. Widely distributed in the Paratethys during the Sarmatian. Zsámbék Basin – Sarmatian.

Elphidium fichtelianum (D'ORBIGNY, 1846)
(Pl. XI, fig. 10)

1846. *Polistomella Fichtelliana* D'ORBIGNY; D'ORBIGNY, p. 125, Taf. 6, Fig. 7, 8.
1951. *Elphidium fichtelianum* (D'ORBIGNY); MARKS, p. 52, Pl. 6, fig. 12.
1958. *Elphidium fichtellianum* (D'ORBIGNY); VENGLINSKI, p. 116, Tabl. XXIV, fig. 4.
1963. *Elphidium fichtelianum* (D'ORBIGNY); PAPP, p. 268, Taf. 11, Fig. 1, 2.
1964. *Elphidium fichtellianum* (D'ORBIGNY); KORECZ-LAKY, p. 354. Taf, I, Fig. 4.
1970. *Elphidium fichtellianum* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 118, pl. 71, fig. 3.
1973. *Elphidium fichtellianum* (D'ORBIGNY); KORECZ-LAKY, Pl. IV, fig. 3.
1974. *Elphidium fichtelianum* (D'ORBIGNY); BRESTENSKÁ, p. 260, Taf, 6, Fig. 2.
1982. *Elphidium fichtellianum* (D'ORBIGNY); KORECZ-LAKY, Pl. V, Fig. 1, 2.
1985. *Elphidium fichtelianum* (D'ORBIGNY); PAPP et SCHMID, p. 50, Pl. 40,. figs. 1-5.

Material. Over 300 specimens.

Description. Test nearly oval to circular, strongly compressed, biumbilicate, planispirally coiled; periphery sharply angled and carinate; the last whorl consists of sixteen to eighteen narrow chambers; sutures distinct, depressed and curved; ponticuli long and up to twelve on the last chambers; umbilicus slilghtly depressed, without central pillar; wall finely perforate; surface finely granulated; aperture a low slit or a row of small pores at the base of the apertural face.

Dimensions. Diameter: 0.4-0.8 mm; thickness: 0.12-0.18 mm.

Variability. Remarkable and constant character of this specimens is the very flattened test shape. The outline of the test ranges from oval to circular.

Remarks. The specimens from Zsámbék Basin can be well identified with the type described by D'ORBIGNY, 1846.

Distribution. Eocene to Recent. Type locality: Austria: Nussdorf in Vienna Basin – Badenian – Sarmatian. Widely distributed in Paratethys, especially common in the Lower Sarmatian. Zsámbék Basin – Sarmatian, *Elphidium reginum* and *Elphidium hauerinum* zone.

Elphidium flexuosum reussi MARKS, 1951
(Pl. XI, figs. 11-12)

1951. *Elphidium flexuosum reussi* MARKS; MARKS, p. 53, Taf, 6. Fig. 7.
1963. *Elphidium flexuosum reussi* MARKS; PAPP, p. 271, Taf. 13, Fig. 3.
? 1974. *Elphidium microelegans* SEROVA; BRENSTENSKÁ, p. 262, Taf. 5, Fig. 6.

Material. Over 100 specimens.

Description. Test relatively small, lenticular, planispirally enrolled, involute; periphery keeled; twelve to fourteen chambers visible on the last whorl, somewhat inflated; sutures distinct, depressed and slightly curved; ponticuli narrow, six to nine on each chamber; umbilicus prominent, smooth and polished; wall relatively thin and finely perforate; surface smooth; aperture a row of small pores at the low and broad apertural face.

Dimensions. Diameter: 0.22-0.31 mm; thickness: 0.09-0.11 mm.

Variability. The characteristic and constant feature of this species is the polished and prominent umbilical boss. The edge may be more or less keeled.

Remarks. The specimens of Zsámbék Basin are identical in detail with the type described and illustrated by MARKS, 1951. This subspecies differs from the other one in its fewer chambers, and large, smooth, polished and convex umbilical boss.

Distribution. Type locality: Austria: Beethovenansicht, Nussdorf in Vienna Basin – Badenian; Czecho-Slovakia – Sarmatian; Hungary: Zsámbék Basin – Sarmatian.

Elphidium hauerinum (D'ORBIGNY, 1846)
(Pl. XII, figs. 1-5)

1846. *Polystomella Hauerina* D'ORBIGNY; D'ORBIGNY, p. 122, Taf. 6, Fig. 1, 2.
1846. *Polystomella Antonina* D'ORBIGNY; D'ORBIGNY, p. 128, Taf. 6, Fig. 17, 18.
1846. *Polystomella Listeri* D'ORBGINY; D'ORBIGNY, p. 128, Taf. 6, Fig. 19-22.
1951. *Elphidium antoninum* (D'ORBIGNY); MARKS, p. 51.
1951. *Elphidium hauerinum* (D'ORBIGNY); MARKS, p. 52.
1958. *Elphidium antoninum* (D'ORBIGNY); VENGLINSKI, p. 114, Tabl. 25, fig. 3.
1958. *Elphidium hauerinum* (D'ORBIGNY); VENGLINSKI, p. 118, Tabl. 26, fig. 3.
1960. *Elphidium hauerinum* (D'ORBIGNY); STANCHEVA, p. 20, Tabl. II, fig. 9.
1960. *Elphidium antoninum* (D'ORBIGNY); STANCHEVA, p. 21, Tabl. III, fig. 12.
1963. *Elphidium antoninum* (D'ORBIGNY); PAPP, p. 262, Taf. 10, Fig. 3-5.
1963. *Elphidium hauerinum* (D'ORBIGNY); PAPP, p. 263, Taf. 10, Fig. 6.
1963. *Elphidium listeri* (D'ORBIGNY); PAPP, p. 273, Taf. 12, Fig. 9.
1964. *Elphidium hauerinum* (D'ORBIGNY); KORECZ-LAKY, p. 479, Taf. 1, Fig. 7.
1968. *Elphidium hauerinum* (D'ORBIGNY); KORECZ-LAKY, p. 91, Taf. 1, Fig. 8.
1970. *Elphidium antonina* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 116, Tabl. 70, fig. 2.
1970. *Elphidium hauerinum* (D'ORBIGNY); IBIDEM, p. 119, Tabl. 72, fig. 2.
1974. *Elphidium antoninum* (D'ORBIGNY); BRESTENSKÁ, p. 262, Taf. 7, Fig. 1.
1974. *Elphidium hauerinum* (D'ORBIGNY); IBIDEM, p. 262, Taf. 7, Fig. 2.
1982. *Elphidium hauerinum* (D'ORBIGNY); KORECZ-LAKY, pl. IV, fig. 1, 2.
1985. *Elphidium hauerinum* (D'ORBIGNY); PAPP et SCHMID, p. 49, Pl. 38, figs. 5-10, p. 51, Pl. 41, figs. 5-10, Pl. 42, figs. 1-4.

Material. Over 2000 specimens.

Description. Test medium-size, nearly circular in outline, biumbilicate, planispirally enrolled, involute; periphery rounded; eight to fourteen inflated chambers in the final whorl; sutures distinct, depressed and nearly straight or slightly curved; ponticuli broad and short, six to nine on each chamber; no central pillar; umbilicus flat or slightly depressed; wall finely perforate and shiny; surface smooth, except sometimes the umbilicus ornamented with fine pearls; multiple aperture at the base of the septal face.

Dimensions. Diameter: 0.2-0.45 mm; thickness: 0.09-0.19 mm.

Variability. The chambers may be more or less inflated. Periphery varies from broadly rounded to subrounded. Sometimes the umbilicus granulated.

Remarks. We accept the revision of PAPP at SCHMID (1985), that *Elphidium antoninum* (D'ORBIGNY) and *Elphidium listeri* (D'ORBIGNY) are synonymous with *Elphidium hauerinum* (D'ORBIGNY).

Distribution. During Sarmatian widely distributed in Paratethys, especially abundant in the upper part of the Lower Sarmatian, therefore it is named after this species, *Elphidium hauerinum* zone.

Elphidium macellum (FICHTEL et MOLL, 1798)
(Pl. XII, figs. 6-8)

non 1798. *Nautilus macellus var.* α FICHTEL et MOLL; FICHTEL et MOLL, p. 68, Taf. 10, Fig. e-g.
1798. *Nautilus macellus var.* β FICHTEL et MOLL; IBIDEM, p. 68, Taf. 10, Fig. h, i, k.
1951. *Elphidium macellum* (FICHTEL et MOLL); MARKS, p. 53.
1958. *Elphidium macellum* (FICHTEL et MOLL); VENGLINSKI, p. 123, Tabl. XXIV, fig. 3, Tabl. XXVI, fig. 4.
1962. *Elphidium macellum convexia* VENGLINSKI; VENGLINSKI, p. 104, Tabl. XVI, fig. 1.
1964. *Elphidium macellum* (FICHTEL et MOLL); KORECZ-LAKY, p. 479, Taf. I, Fig. 5.
? 1964. *Elphidium macellum var. aculeatum* SILVESTRI; KORECZ-LAKY, p. 479, Taf. I, Fig. 4.
1968. *Elphidium macellum* (FICHTEL et MOLL); KORECZ-LAKY, p. 91, Taf. I, Fig. 15.
1970. *Elphidium macellum* (FICHTEL et MOLL); DIDKOWSKI et SATANOVSKAJA, p. 121, Tabl. 72. fig. 7.

1970. *Elphidium macellum converia* VENGLINSKI; VENGLINSKI, p. 12, Tabl. 72, fig. 6.

? 1973. *Elphidium macellum var. aculeatum* SILVESTRI; KORECZ-LAKY, Pl. IV, fig. 13.

1974. *Elphidium macellum* (FICHTEL et MOLL); BRESTENSKÁ, p. 263, Taf. 6, Fig. 4.

1982. *Elphidium macellum* (FICHTEL et MOLL); KORECZ-LAKY, Pl. I, fig. 3, 4.

1985. *Elphidium macellum* (FICHTEL et MOLL); RÖGL et HANSEN, p. 50, Pl. 14, Fig. 2, 5, 6, Pl. 15, Fig. 1, 2, Textfig. 18 B.

1991. *Elphidium macellum* (FICHTEL and MOLL); CIMERMAN and LANGER, p. 78, pl. 89, fig. 9.

Material. Over 3000 specimens.

Description. Test planispiral, involute, nearly circular in outline, slightly flattened, lenticular; periphery sharply angled and keeled; eleven to twelve chambers are in the final whorl; sutures distinct, depressed and gently curved; ponticuli long, distinct, seven to fifteen on each chamber; fossettes granulated; umbilicus flat or slightly depressed, without umbilical plug and ornamentation; wall optically radial; multiple aperture, with small protruding lips at the base of the low septal face.

Dimensions. Diameter: 0.35-0.8 mm; thickness: 0.2-0.35 mm.

Variability. The periphery may more or less harp.

Remarks. According to RÖGL et HANSEN (1984) *Nautilus macellus* var. α FICHTEL et MOLL corresponds to *E. planulatum* (LAMARCK, 1822). The distinctive features of the latter species are the more flattened test, more chambers per whorl and having multiple additional areal apertures.

This species differs from *Ephidium crispum* (LINNÉ) in its more flattened test shape and depressed umbilicus, without ornamentation.

Rarely small spines appear on the keel at the older part of the last whorl, as in MARKS (1951), VENGLINSKI (1958) and KORECZ-LAKY (1964 and 1973). Possibly these are transitional forms between. *E. aculeatum* and *E. macellum.*

Distribution. Eocene – Recent: Mediterranean Sea (CIMERMAN and LARGER, 1991). Very common in the Middle Sarmatian. Hungary: Tokaj Mts., Mecsek Mts. – Lower Sarmatian, Zsámbék Basin – Sarmatian.

Elphidium obtusum (D'ORBIGNY, 1846)
(Pl. XII,f igs. 9-10)

1846. *Polystomella obtusa* D'ORBIGNY; D'ORBIGNY, p. 124, Taf. 6, Fig. 5, 6.
? 1960. *Elphidium obtusum* (D'ORBIGNY); STANCHEVA, p. 261, Tabl. 9, fig. 4.
1963. *Elphidium obtusum* (D'ORBIGNY); PAPP, p. 261,Taf.9, Fig. 4.
1985. *Elphidium obtusum* (D'ORBIGNY); PAPP et SCHMID, p. 50, Pl. 39, figs. 5, 6.

Material. Over 150 specimens.

Description. Test lenticular in shape, planispirally coiled, involute; periphery subacute; thirteen to twenty chambers on the last whorl; sutures distinct and curved; ponticuli short, eight to ten on each chamber; umbilicus flat or sometimes slightly depressed; no central pillar; wall finely perforate; surface smooth; multiple aperture at the base of the septal face.

Dimensions. Diameter: 0.4-0.7 mm; thickness: 0.22-0.34 mm.

Variability. The distinctive and constant features of this species are the large number of the chambers and the subacute periphery without carinae.

Remarks. This species resembles *Elphidium hauerinum* (D'ORBIGNY), from which it differs in its larger test, more chambers on the last whorl and subacute periphery. STANCHEVA (1960) mentioned only ten to fourteen chambers on the final whorl, the other characters are the same.

Distribution. Austria: Vienna Basin – Eggenburgian to Sarmatian; North-Western Bulgaria – Lower Sarmatian. Hungary: Zsámbék Basin – Sarmatian, from the *Elphidium reginum* zone, to lower part of the *Spirolina austriaca* zone. Common in the Lower Sarmatian, together with *E. hauerinum.*

Elphidium reginum (D'ORBIGNY, 1846)
(Pl. XII, fig. 11)

1846. *Polystomella regina* D'ORBIGNY; p. 129, Taf. 6, Fig. 23, 24.
1951. *Elphidium reginum* (D'ORBIGNY); MARKS, p. 53.
1952. *Elphidium regina* (D'ORBIGNY); VOLOSHINOVA, p. 39, Tabl. IV, fig. 7-9.

1952. *Elphidium regina var. caucasina* BOGDANOWICH; VOLOSHINOVA, p. 40, Tabl. IV, fig. 8-9.
1958. *Elphidium reginum* (D'ORBIGNY); VENGLINSKI, p. 123, Tabl. XXIII. fig. 2, Tabl. XXIV, fig. 1, 2.
1958. *Elphidium georgium* VENGLINSKI; VENGLINSKI, p. 119, Tabl. XXIII.fig. 1.
1960. *Elphidium reginum* (D'ORBIGNY); STANCHEVA, p. 20, Tabl. III, fig. 7.
1963. *Elphidium reginum* (D'ORBIGNY); PAPP, p. 275, pl. 11, Fig.8.
1964. *Elphidium reginum* (D'ORBIGNY); KORECZ-LAKY, p. 479, Taf. I, Fig. 2.
1965. *Elphidium georgium* VENGLINSKI; KORECZ-LAKY, p. 354. Taf. I, Fig. 55.
1968. *Elphidium imperatrix* (BRADY); KORECZ-LAKY, p. 91, Taf. I, Fig. 16.
1968. *Elphidium reginum* (D'ORBIGNY); KORECZ-LAKY, p. 92.
1970. *Elphidium regina* (D'ORBIGNY); DIDKOWSKI et SATANOVSKAJA, p. 124, Tabl. 74, fig. 6.
1970. *Elphidium regina georgium* (VENGLINSKI); DIDKOWSKI et SATANOVSKAJA, p. 124, Tabl. 74, fig. 8.
1970. *Elphidium regina caucasicum* BOGDANOWICH; DIDKOWSKI et SATANOVSKAJA, p. 124, Tabl. 74, fig.7.
1974. *Elphidium georgium* VENGLINSKI; KORECZ-LAKY, pl. IV, fig. 4.
1973. *Elphidium reginum* (D'ORBIGNY); KORECZ-LAKY, p. IV, fig. 8.
1974. *Elphidium reginum* (D'ORBIGNY); BRESTENSKÁ, p. 260, Taf. 6, Fig. 3, 5, 6.
1982. *Elphidium imperatrix* (BRADY); KORECZ-LAKY, pl. II, fig. 3, 4. Pl. III, fig. 1-4.
1985. *Elphidium reginum* (D'ORBIGNY); PAPP et SCHMID, p. 52, Pl. 42, figs. 5-9, Pl. 43, fig. 8.

Material. Over 400 specimens.

Description. Test large, nearly circular to irregular in outline, flattened, planispirally coiled, involute; periphery acute; thirteen to twenty slightly inflated chambers on the final whorl; sutures distinct and strongly curved at the periphery; ponticuli long, seven to fifteen on each chamber; umbilicus flat or slightly depressed; a few long spines appear on the edge; wall finely perforate; surface finely granulated except the spines, which smooth and polished; multiple aperture at the base of the septal face.

Dimensions: Diameter: 0.4-1.2 mm; thickness: 0.15-0.25 mm.

Variability. The test shape is variable, often irregular. The number of the spines varies from three to five and may be longer or shorter.

Remarks. The remarkable character of this species is the long spines at the periphery.

Distribution. The type locatlity of this species is Baden in Vienna Basin, according to PAPP (1963) and PAPP et SCHMID (1985) it is probably came to daylight from the Sarmatian layers. From the other part of Paratethys *E. reginum* occured only in the Sarmatian formations. Especially typical in the Lower Sarmatian, but it was mentioned from the Middle Sarmatian of Eastern Paratethys (VENGLINSKI, 1975; DIDKOWSKI et SATANOVSKAJA, 1970). This is a species endemic to the Paratethys and it is regard as index fossil for the Sarmatian.

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PLATE I

Fig. 1. *Spiroloculina okrojantzi* BOGDANOWICH. Sarmatian, *Elphidium reginum* zone. Mány–17. borehole, depth 147.1-147.5 mm; Front view of a specimen.

N: 40x

Fig. 2. *Nodophthalmidium aff. prima* (BOGDANOWICH). Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.6-150.4 m; Oblique view with aperture.

N: 150x

Fig. 3-4. *Nodophthalmidium rugosum n. sp.*, Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.1-147.5 m;

3 – side view, holotype;

N: 74x

4 – oblique view of initial part with aperture, paratype.

N: 130x

Fig. 5. *Nodophtalpmidium asperum n. sp.*, Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 142-144 m; Slightly oblique view with narrow slit-like aperture, holotype.

N: 70x

Fig. 6. *Nodobacullariella didkowskii* BOGDANOWICH. Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 177.2-178.2 m; Oblique side view with large aperture.

N: 80x

Fig. 7-9. *Nodobacullariella ovalis* VENGLINSKI. Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 177.2-178.2 m;

7, 8 – opposite sides;

7 - N: 150x
8 - N: 100x

9 – apertural view.

N: 160 x

Fig. 10-12. *Nodobacullariella sulcata* (REUSS). Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 177.2-178.2 m;

10, 11 – opposite sides;

10 - N: 70x
11 - N: 90x

12 – side view with aperture.

N: 110x

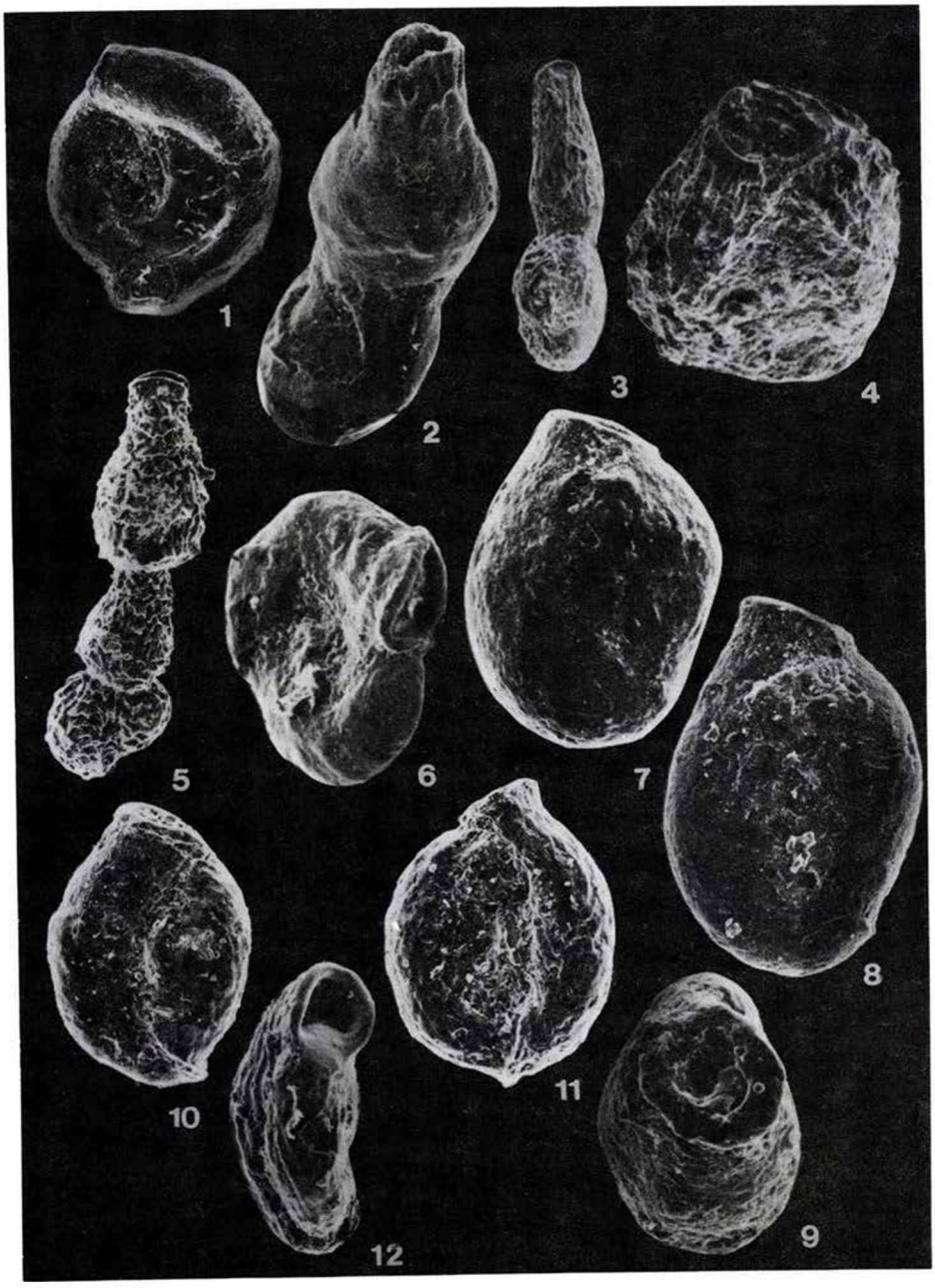
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PLATE II

Fig. 1-4. *Schlumbergerina fabularoides* (KARRER). Sarmatian, *Spirolina austriaca* zone. Mány-22. borehole, depth 41.7-42.6 m;

1 – front view;

N: 30x

2 – front view of an irregularly coiled specimen;

N: 60x

3 – apertural view with termatophore;

N: 100x

4 – aperture with termatophore damaged, showing crenellated border.

N: 140x

Fig. 5 - 8. *Siphonaperta longidentata n. sp.*, Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.1-147.5 m;

5 – front view, paratype;

N: 130x

6 – oblique view with aperture, paratype; 5 and 6 are opposite sides.

N: 80x

7 – apertural view, paratype;

N: 120x

8 – apertural view, elongated aperture with long, simple tooth.

N: 110x

Fig. 9-11. *Cycloforina badenensis* D'ORBIGNY. Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 45-52 m;

9, 10 – opposite sides;

9 - N: 90x
10 - N: 70x

11 – oblique view with aperture.

N: 150x

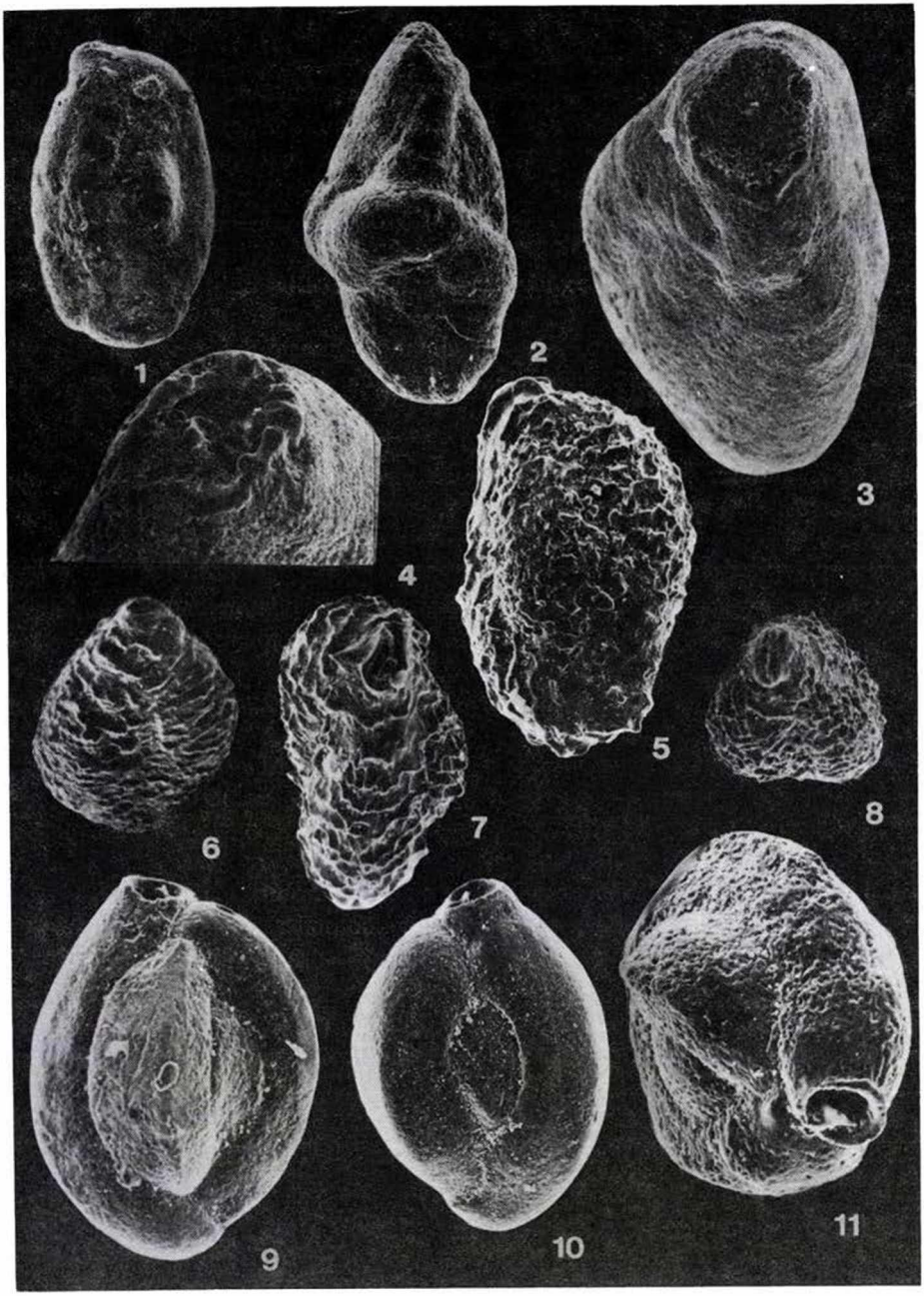
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PLATE III

Fig. 1-3. *Cycloforina contora* (D'ORBIGNY). Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 92.0-92.3 m;

1 – front view of a sharply carinated specimen;

N: 100x

2 – front view of a specimen with blunt carinae;

N: 80x

3 – oblique view with circular aperture and bifid tooth.

N: 75x

Fig. 4 - 6. *Cycloforina fluviata* (VENGLINSKI). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 39.8-41.1 m;

4, 5 – opposite sides;

4 - N: 120x

5 - N: 150x

6 – oblique view with aperture.

N: 140x

Fig. 7-9. *Cycloforina predkarpatica* (SEROVA). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 45-52 m;

7,8 – opposite sides;

7 - N: 65x

8 - N: 80x

9 – apertural view.

N: 100x

Fig. 10-11. *Cycloforina stomata* LUCZKOWSKA. Sarmatian. *Spirolina austriaca* zone, Mány-22. borehole, depth 45-52 m;

10 – front view;

N: 140x

11 – apertural view.

N: 100x

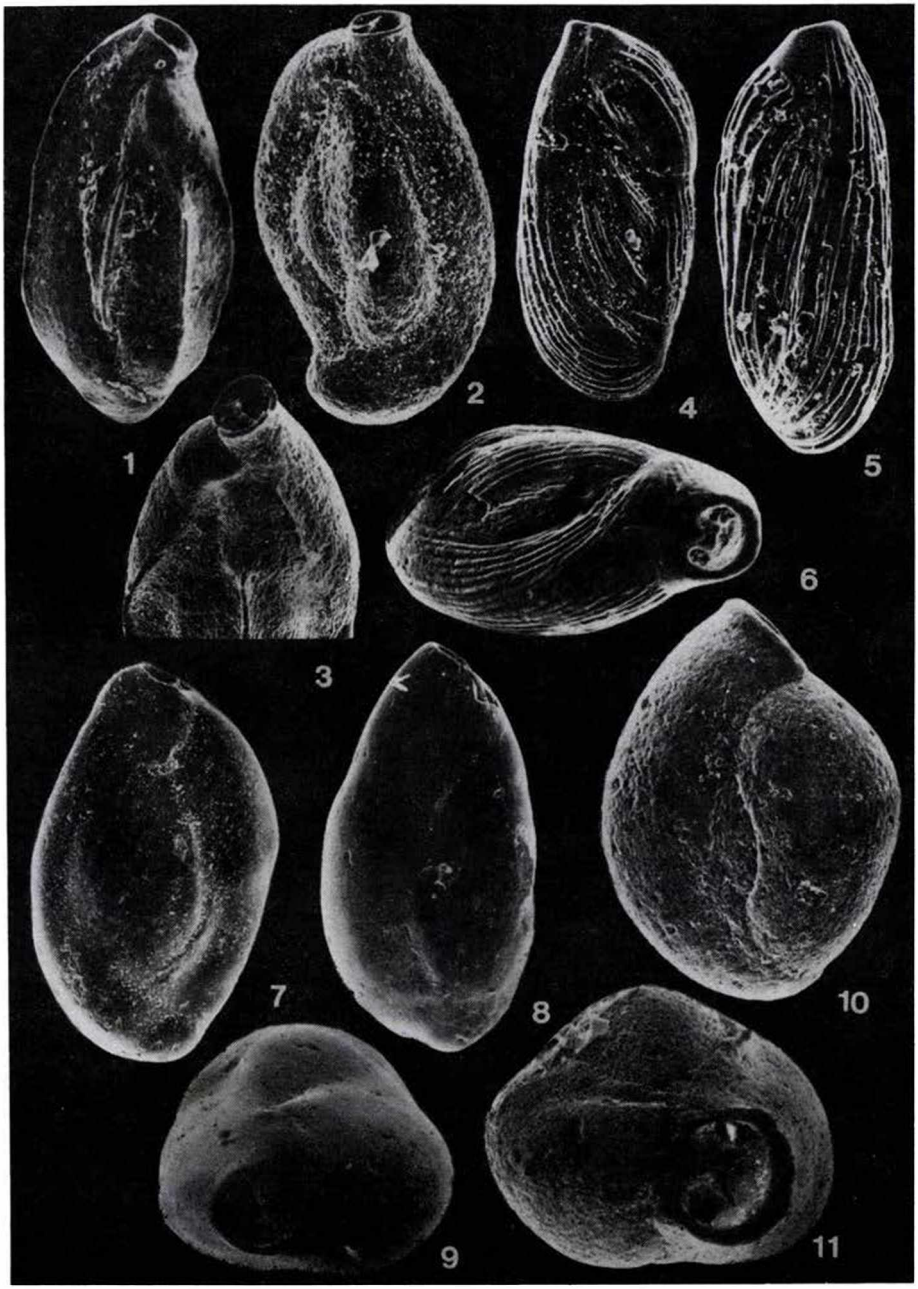
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PLATE IV

Fig. 1-2. *Cycloforina toreuma* (SEROVA). Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 170.6-173 m;
1,2 - opposite sides.

1 - N: 140x
2 - N: 120x

Fig. 3-5. *Cycloforina vermicularis* (KARRER). Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 95.8-96.8 m;
3,4 - opposite sides;

3 - N: 90x
4 - N: 160x

5 - front view of an adult specimen with irregular longitudinal striae.

N: 70x

Fig. 6-9. *Hauerina irschavensis* VENGLINSKI et BURINDINA. Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 39.8-41.4 m;
6,7 - front views of adult specimens with triangular, termathophore aperture;

6 - N: 110x
7 - N: 70x

8 - oblique view of a juvenile specimen with nearly circular, termathophore aperture;

N: 70x

9 - front view of a juvenile specimen with convex and clearly visible middle chamber;

N: 75x

Fig. 10-12. *Hauerina podolica* SEROVA. Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 39.8-41.4 m;
10, 11 - opposite sides;

10 - N: 140x
11 - N: 150x

12 – apertural view with termathophore aperture.

N: 130x

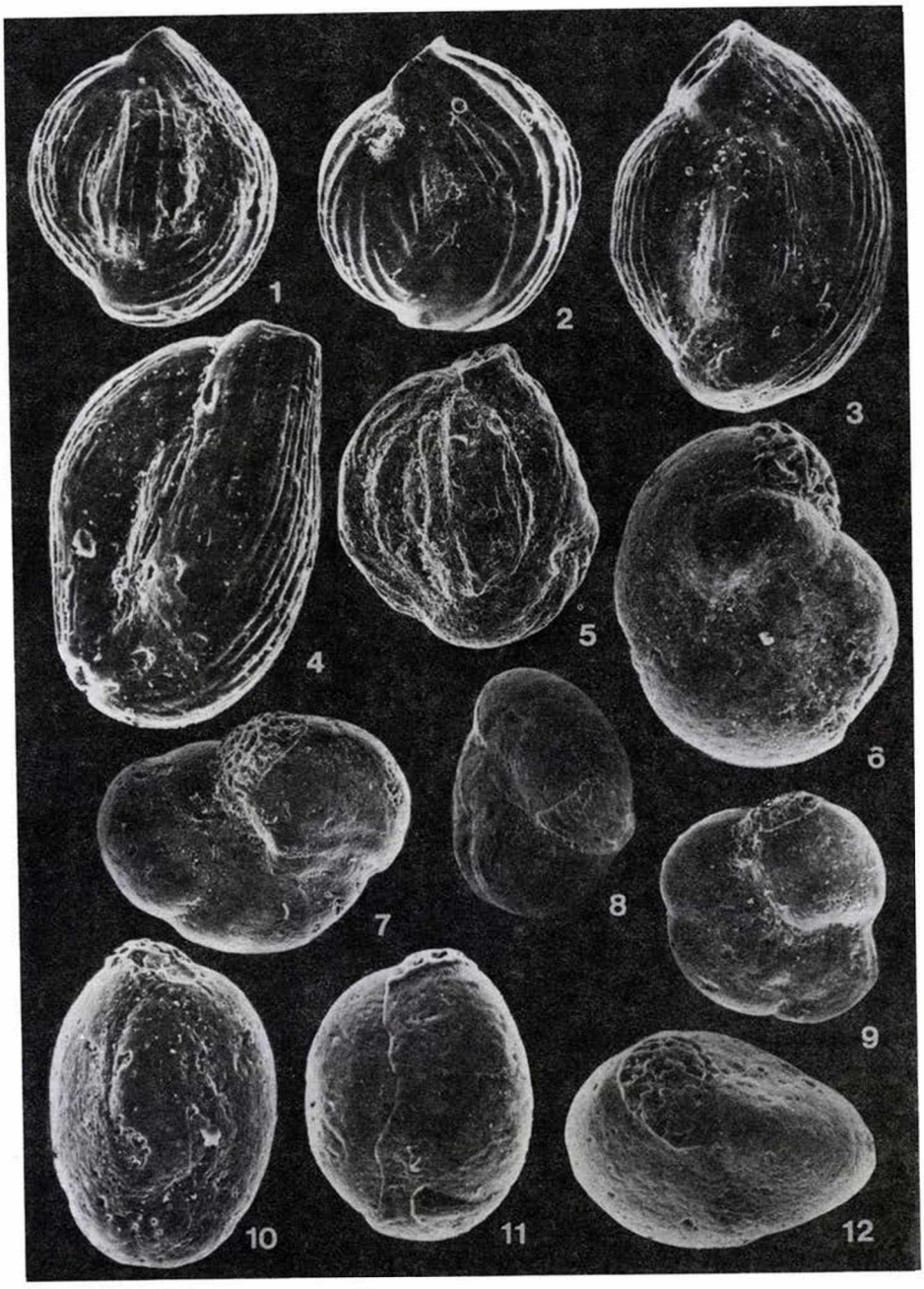
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PLATE V

Fig. 1-3. *Quinqueloculina anagallis* LUCZKOWSKA. Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 41.7-42.6 m;
1,2 - opposite sides;

1 - N: 80x
2 - N: 60x

3 - oblique view of a strongly striated specimen with aperture.

N: 70x

Fig. 4-7. *Quinqueloculina buchiana* D'ORBIGNY. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.1-147.5 m;
4 - front view of quinqueloculine stage;

N: 100x

5 - apertural view of quinqueloculine stage;

N: 90x

5,7 - opposite sides of massiline stage;

6 - N: 60x
7 - N: 50x

Fig. 8-10. *Affinetrina cubanica* (BOGDANOWICH). Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 98.1-99.1 m;
8,9 - opposite sides;

8 - N: 150x
9 - N: 130x

10 - side view with oblique aperture.

N: 200x

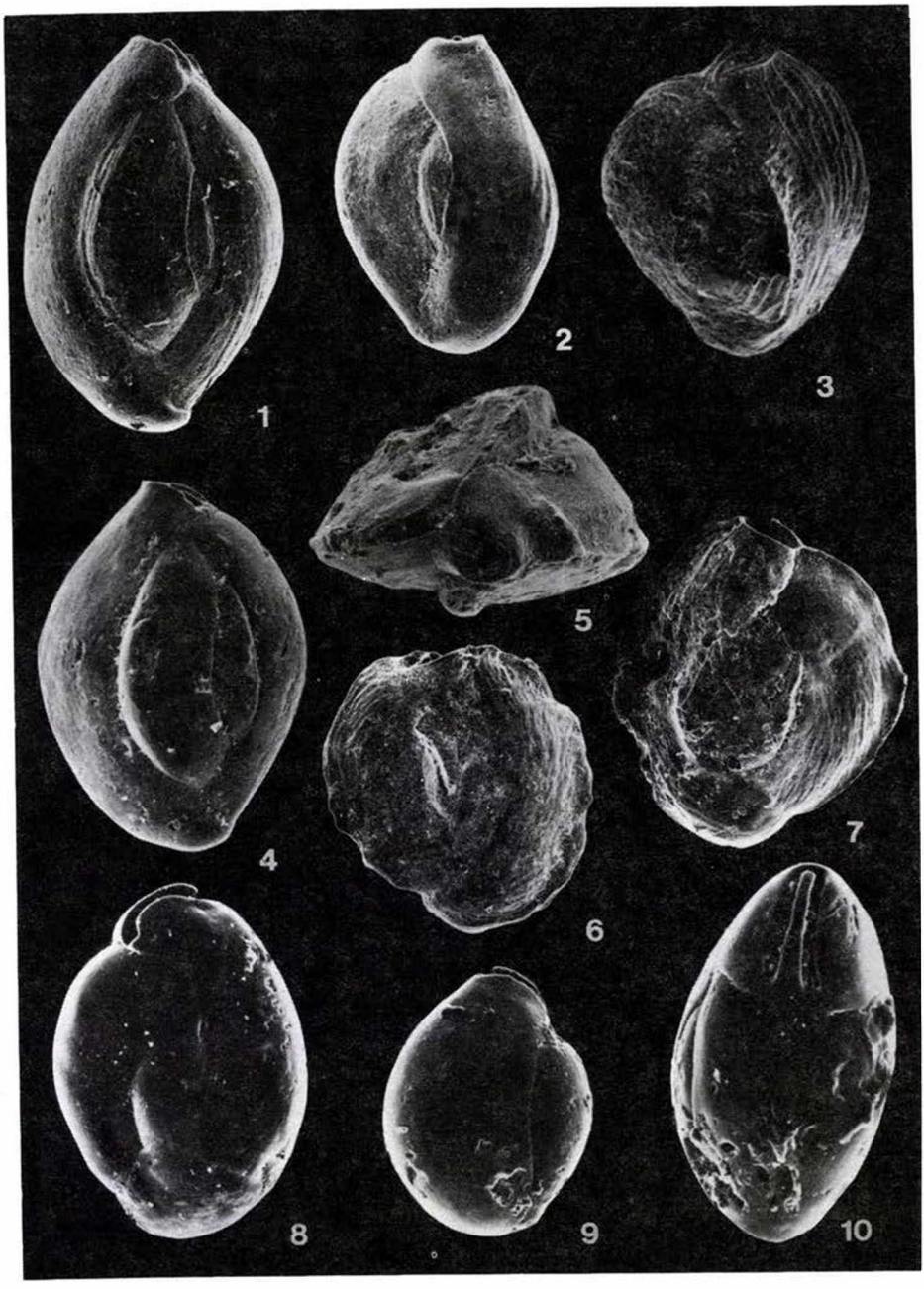
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PLATE VI

Fig. 1-3. *Affinetrina ucrainica* (SEROVA). Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 145.2-145.4 m;
1,2 - opposite sides;

1 - N: 130x
2 - N: 120x

3 - side view with aperture perpendicular to the penultimate chamber, tooth broken.

N: 200x

Fig. 4-5. *Miliolinella banatiana* LUCZKOWSKA. Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 74-80.2 m;
4 - apertural view.

N: 90x

5 - front view.

N: 100x

Fig. 6-8. *Miliolinella selene* (KARRER). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 41.7-42.6 m;
6,7 - opposite sides;

6 - N: 180x
7 - N: 130x

8 - side view with very low aperture and tape-like toothplate.

N: 180x

Fig. 9-10. *Pseudotriloculina consobrina* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.6-150.4 m;
9 - front view;

N: 150x

10 - nearly side view with aperture.

N: 130x

Fig. 11-13. *Pseudotriloculina inflata* (D'ORBIGNY). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 39.8-41.1 m;
11, 12 - opposite sides;

11, 12 - N: 60x

13 - apertural view with large bifid tooth.

N: 70x

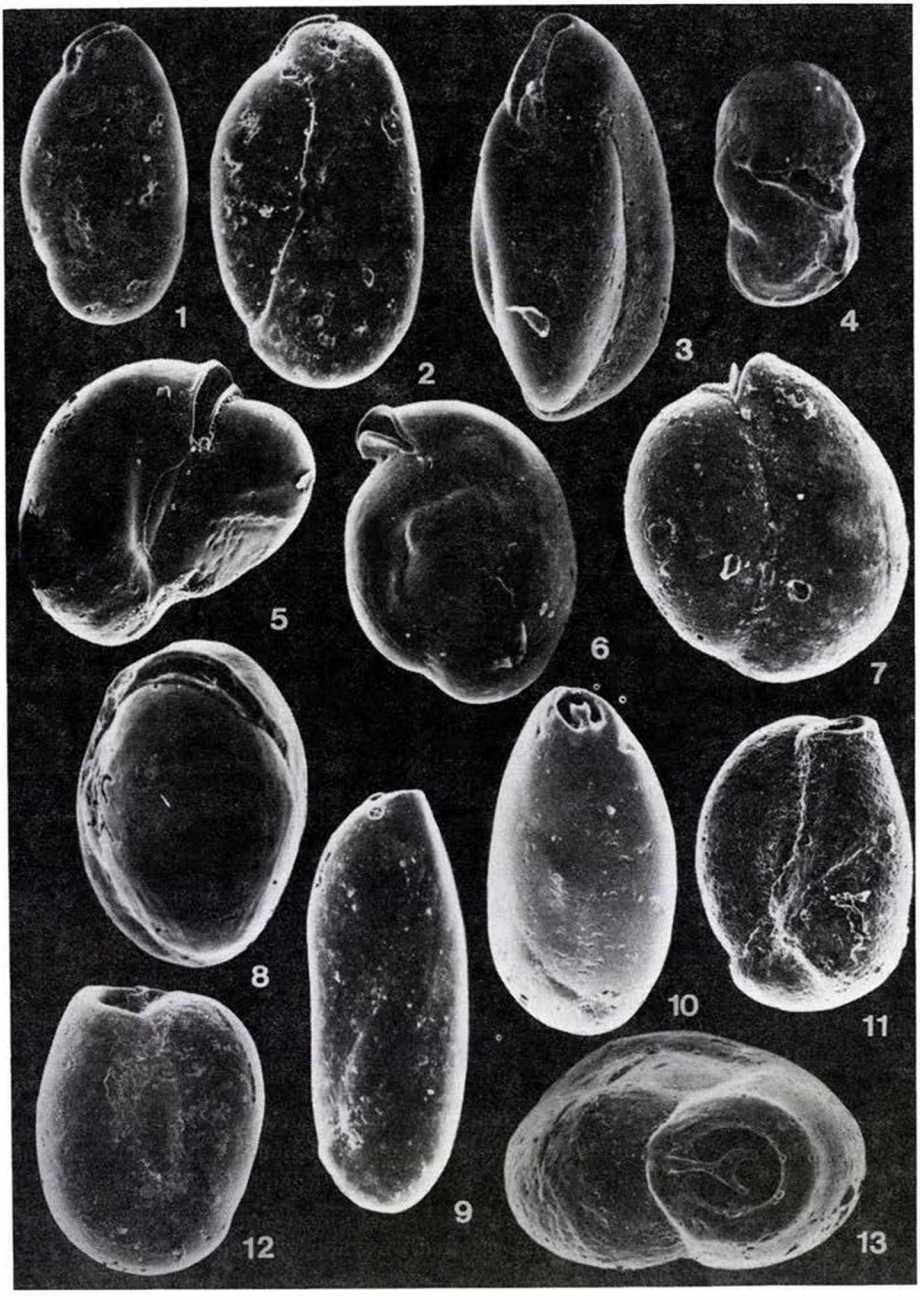
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PLATE VII

Fig. 1-2. *Triloculina gibba* D'ORBIGNY. Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 81.5-85.3 m;

1 - front view of a specimen with only two visible chambers;

N: 60x

2 - front view of a slightly eroded specimen.

N: 80x

Fig. 3-4. *Triloculina intermedia* KARRER. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.1-147.5 m;

3 - oblique view of slightly eroded specimen;

N: 60x

4 - nearly apertural view.

N: 100x

Fig. 5-6. *Varidentella latelacunata* (VENGLINSKI). Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 104.5-106 m;

5 - front view;

N: 100x

6 - nearly apertural view.

N: 150x

Fig. 7-9. *Varidentella pseudocostata* (VENGLINSKI). Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 147.6-150.4 m;

7, 8 - front view, aperture is in oblique position.

7 - N: 160x
8 - N: 140x

9 - side view, with aperture.

N: 120x

Fig. 10-11. *Varidentella reussi* (BOGDANOWICH). Sarmatian, *Spirolina austriaca* zone, Perbál-5. borehole, depth 98-104 m;

10 front view;

N: 210x

11 - front view of a specimen ornamented with irregular wrinkles.

N: 160x

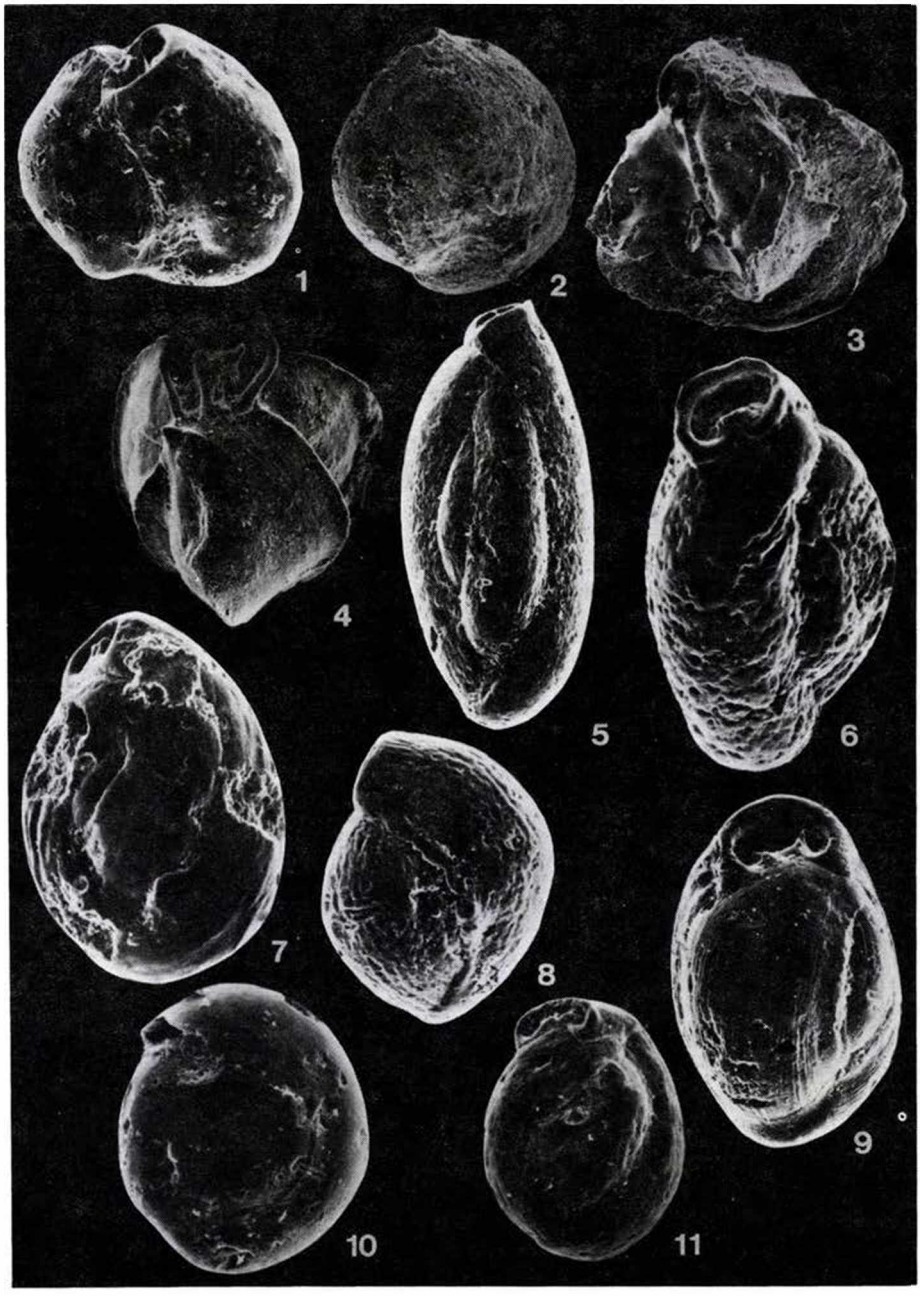
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PLATE VIII

Fig. 1-2. *Varidentella rotunda* (GERKE). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 45-52 m;
1, 2 - front views.

1 - N: 100x
2 - N: 130x

Fig. 3. *Articularia articulinoides* (GERKE et ISSAEVA). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 74-80.2 m; Initial part broken, side view of a chamber.

N: 60x

Fig. 4. *Articulina problema* BOGDANOWICH. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 156.8-158.4 m; Specimen with initial part.

N: 100x

Fig. 5. *Articulina aff. nitida* D'ORBIGNY. Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 141.4-142.7 m; initial part broken.

N: 100x

Fig. 6-9. *Spirolina austriaca* D'ORBIGNY. Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 106-109.6 m;
6 - specimen with uncoiled chambers.

N: 60x

7 - aperture of uncoiled part, round and lobately notched;

N: 120x

8 - side view of coiled part with aperture;

N: 110x

9 - front view of a juvenile specimen.

N: 80x

Fig. 10. *Guttulina communis* D'ORBIGNY. Sarmatian, *Elphidium hauerinum* zone, Mány-17. borehole, depth 111.6-113.5 m;

N: 60x

Fig. 11-12. *Oolina mironovi* (BOGDANOWICH). Sarmatian, *Elphidium hauerinum* zone, Mány-22. borehole, depth 134.6-139 m;
11 - front view;

N: 160x

12 - side view.

N: 160x

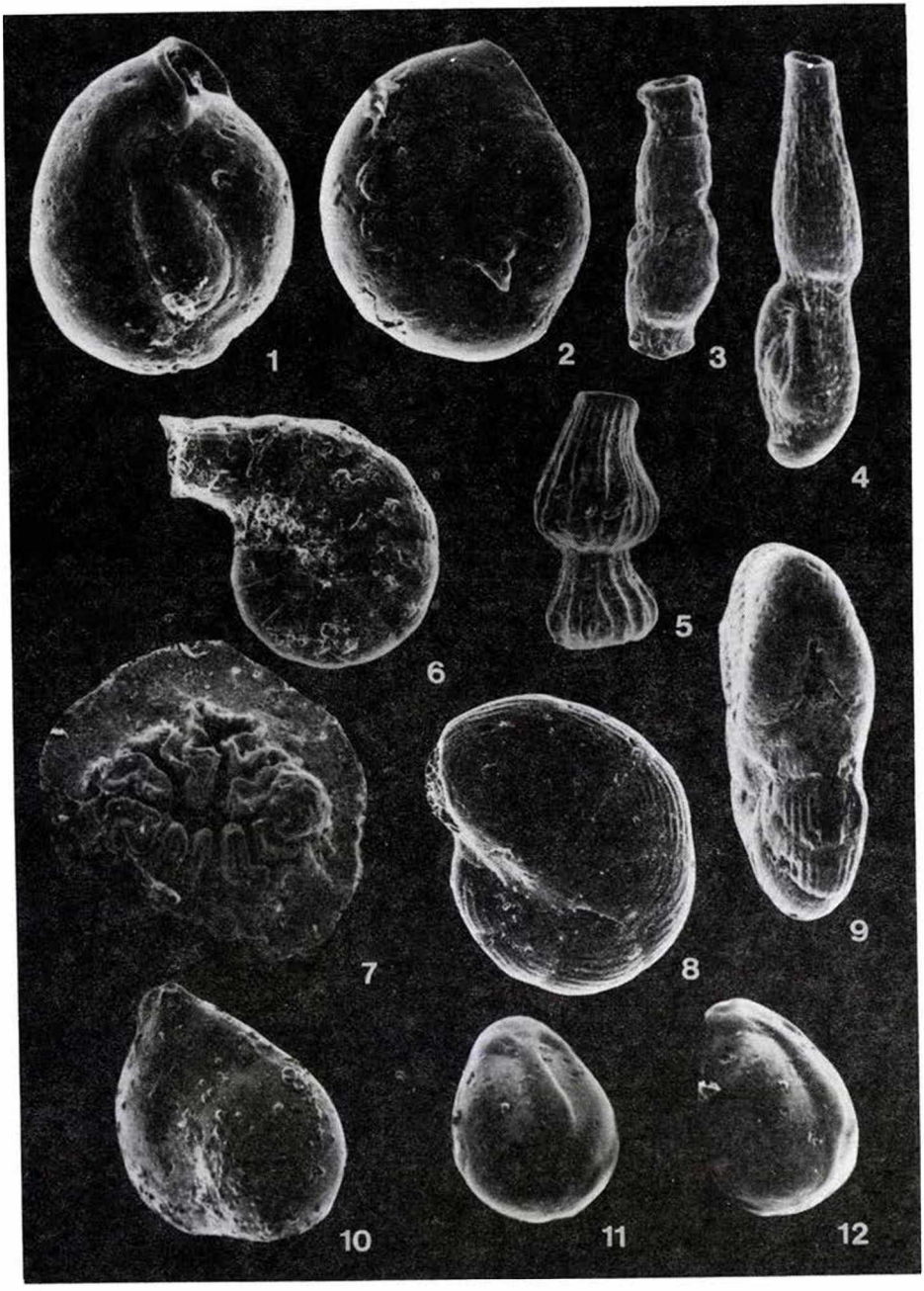
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PLATE IX

Fig. 1. *Bolivina antiqua* D'ORBIGNY. Sarmatian, *Elphidium hauerinum* zone, Mány-17. borehole, depth 111.6-113.5 m; Fron tview.

N: 150x

Fig. 2. *Bolivina moldavica* DIDKOWSKI. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 141.1-143.3 m; Front view.

N: 150x

Fig. 3. *Bolivina moravica* CICHA et ZAPLETALOVA. Sarmatian. *Elphidium hauerinum* zone, Mány-22. borehole, depth 139.2-141.4 m; Front view.

N: 180x

Fig. 4. *Bolivina sagittula* DIDKOWSKI. Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 99.6-109.6 m; Front view.

N: 100x

Fig. 5. *Bolivina sarmatica* DIDKOWSKI. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 141.1-143.3 m; Front view.

N: 230x

Fig. 6-7. *Cassidulina margareta* KARRER. Sarmatian, *Elphidium hauerinum* zone, Mány-22. borehole, depth 139.2-141.4 m;
6,7 - opposite sides.

N: 210x

Fig. 8. *Bulimina elongata* D'ORBIGNY. Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 89.2-90.4 m;

N: 130x

Fig. 9-10. *Buliminella elegantissima* (D'ORBIGNY). Sarmatian, *Elphidium hauerinum* zone, Mány-17. borehole, depth 111.6-113.5 m;
9 - side view with drop-shape aperture;

N: 180x

10 - side view, opposite to the aperture.

N: 160x

Fig. 11-12. *Fursenkoina acuta* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 169.8-172.3 m;
11 - side view, opposite to the aperture.

N: 160x

11 - side view with missing last chamber and with aperture and denticulate toothplate.

N: 220x

Fig. 13. *Caucasina schischkinskye* (SAMOYLOVA). Sarmatian, *Elphidium hauerinum* zone, Mány-22. borehole, depth 139.2-141.4 m; Elongate specimens.

N: 160x

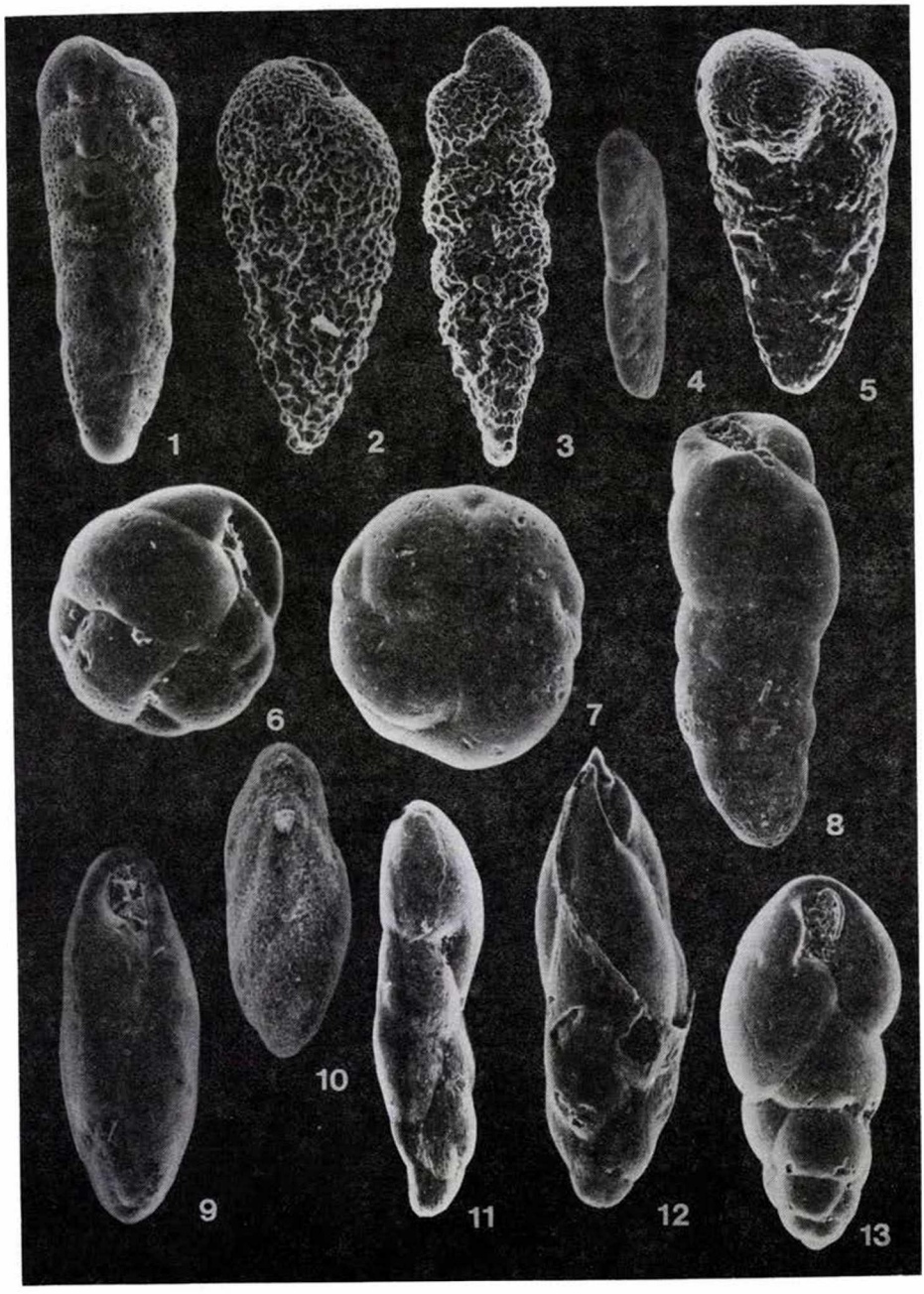
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PLATE X

Fig. 1. *Caucasina schischkinskye* (SAMOYLOVA). Sarmatian, *Elphidium hauerinum* zone, Mány-22. borehole, depth 139.2-141.4 m; Globular specimen with spines and nodes.

N: 200x

Fig. 2-4. *Rosalina obtusa* D'ORBIGNY. Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 155-157.8 m;

2 - dorsal side;

N: 80x

3 - ventral side, perforate.

N: 110x

4 - ventral side, imperforate and umbilicus is ornamented with granules.

N: 160x

Fig. 5-6. *Schackoinella imperatoria* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 155-157.8 m;

5 - dorsal side;

N: 120x

5 - ventral side.

N: 130x

Fig. 7-8. *Cibicides lobatulus* (WALKER et JACOB). Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 153.1-154 m;

7 - dorsal side;

N: 45x

8 - ventral side.

N: 70x

Fig. 9-12. *Aubignyna simplex* (D'ORBIGNY). 9, 11 - Sarmatian, *Spirolina austriaca* zone, Mány-17. borehole, depth 76.5-76.8 m; 10, 12 - Lower Sarmatian, Elphidium reginum zone, Mány-22. borehole, depth 173-175.9 m;

9, 10 dorsal side;

11, 12 - ventral side.

9-11 - N: 120x

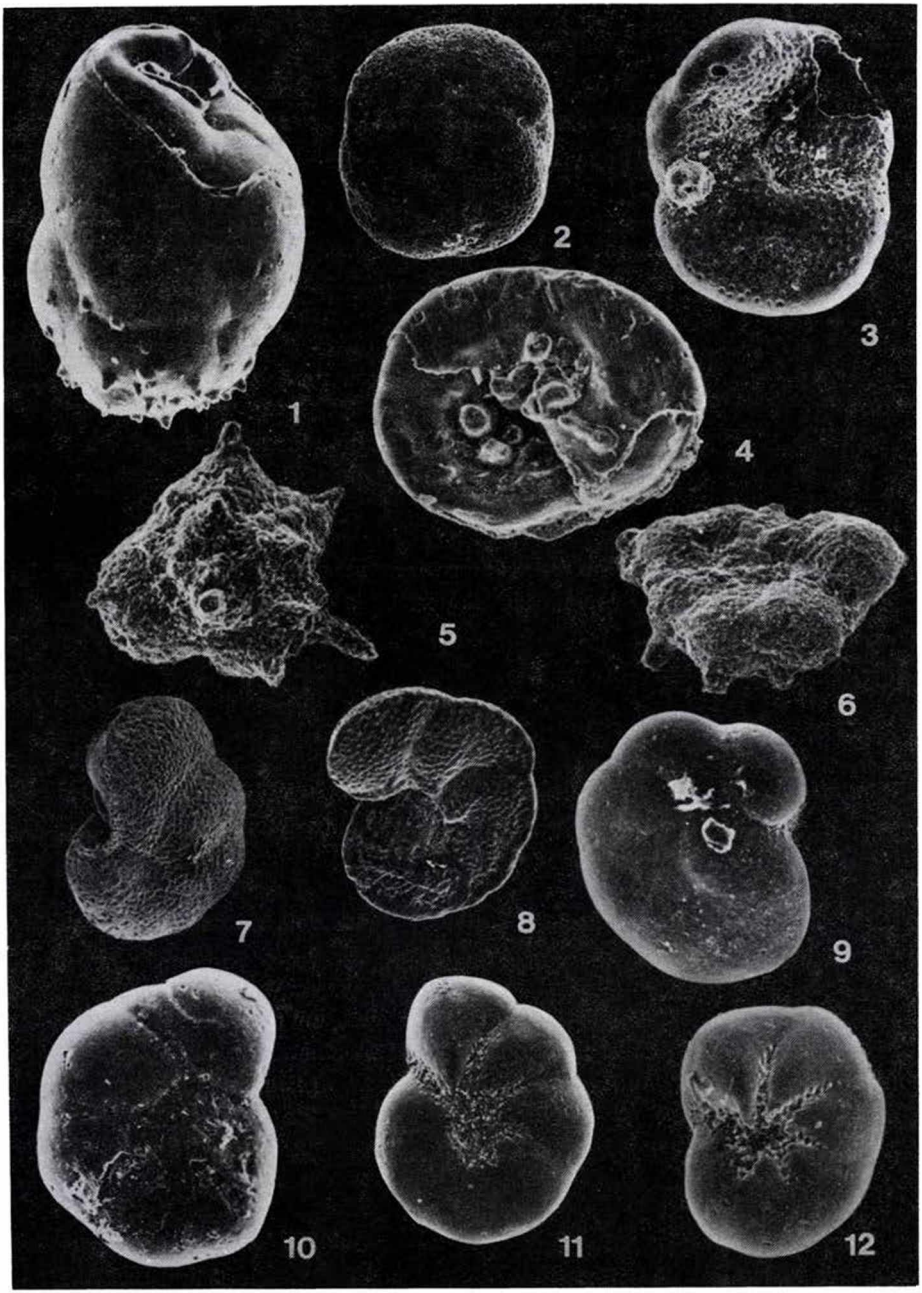
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PLATE XI

Fig. 1-3. *Ammonia beccarii* (LINNÉ). Sarmatian, *Spirolina austriaca* zone, Perbál-5. borehole, depth 98-104 m;

1 - dorsal side;

N: 150x

2 - ventral side;

N: 170x

3 - oblique view of a low trochospiral specimen with aperture and with missing last chambers.

N: 100x

Fig. 4. *Nonion bogdanowiczi* VOLOSHINOVA. Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 170.6-173 m; Side view.

N: 150x

Fig. 5. *Porosononion granosum* (D'ORBIGNY). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 98-104 m; Side view.

N: 80x

Fig. 6-7. *Elphidium aculeatum* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 152.8-153 m;

6 - side view of an adult specimen;

N: 60x

7 - side view of an juvenile specimen.

N: 70x

Fig. 8-9. *Elphidium crispum* (LINNÉ). Sarmatian, *Spirolina austriaca* zone, Mány-22. borehole, depth 41.7-42.6 m;

8 - side view;

N: 80x

9 - apertural view.

N: 60x

Fig. 10. *Elphidium fichtelianun* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Perbál-5. borehole, depth 177.2-178.2 m; Side view.

N: 70x

Fig. 11-12. *Elphidium flexuosum reussi* MARKS. Sarmatian, *Elphidium reginum* zone, Mány-17. borehole,d epth 147.1-147.5 m;

11 - side view;

N: 120x

12 - apertural view.

N: 130x

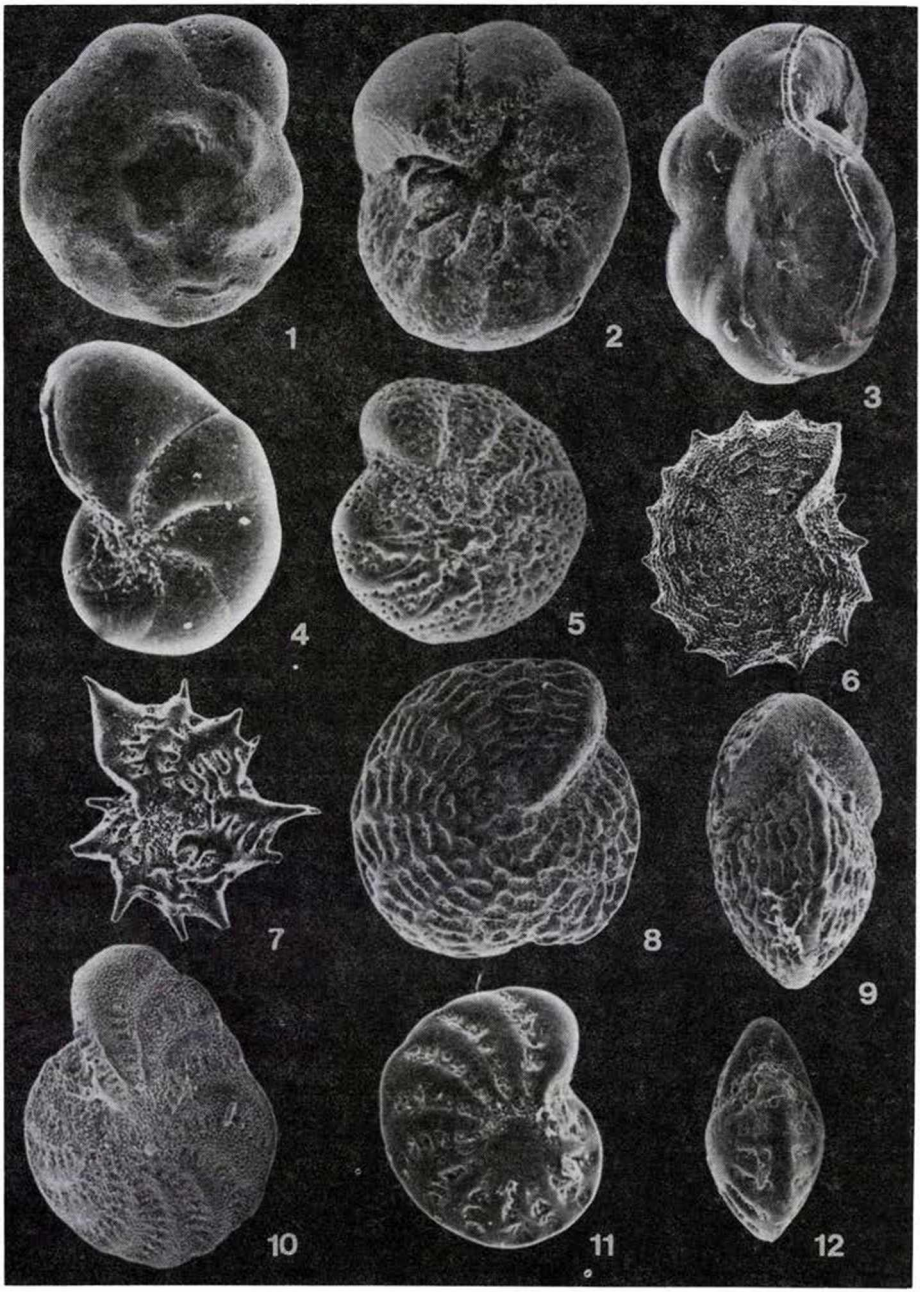
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PLATE XII

Fig. 1-5. *Elphidium hauerinum* (D'ORBIGNY). 1-3 - Sarmatian, *Elphidium hauerinum* zone, Perbál-5. borehole, depth 128.8-134.4 m; 4,5 - Lower Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 149.9-153.3 m;

1, 2 - side view;

3 - oblique apertural view;

4, 5 - "Siamese" twins specimen.

1-5 - N: 140x

Fig. 6-8. *Elphidium macellum* (FICHTEL et MOLL). Sarmatian, *Elphidium reginum* zone, Mány-22. borehole, depth 170-173 m;

6 - side view;

N: 70x

7 - apertural view;

N: 100x

8 - apertural view of a "Siamese" twins specimen.

N: 60x

Fig. 9-10. *Elphidium obtusum* (D'ORBIGNY). Sarmatian, *Spirolina austriaca* zone, Perbál-5. borehole, depth 98-104 m;

9 - apertural view;

N: 120x

10 - side view.

N: 85x

Fig. 11. *Elphidium reginum* (D'ORBIGNY). Sarmatian, *Elphidium reginum* zone, Mány-17. borehole, depth 150.8-151.8 m; Side view.

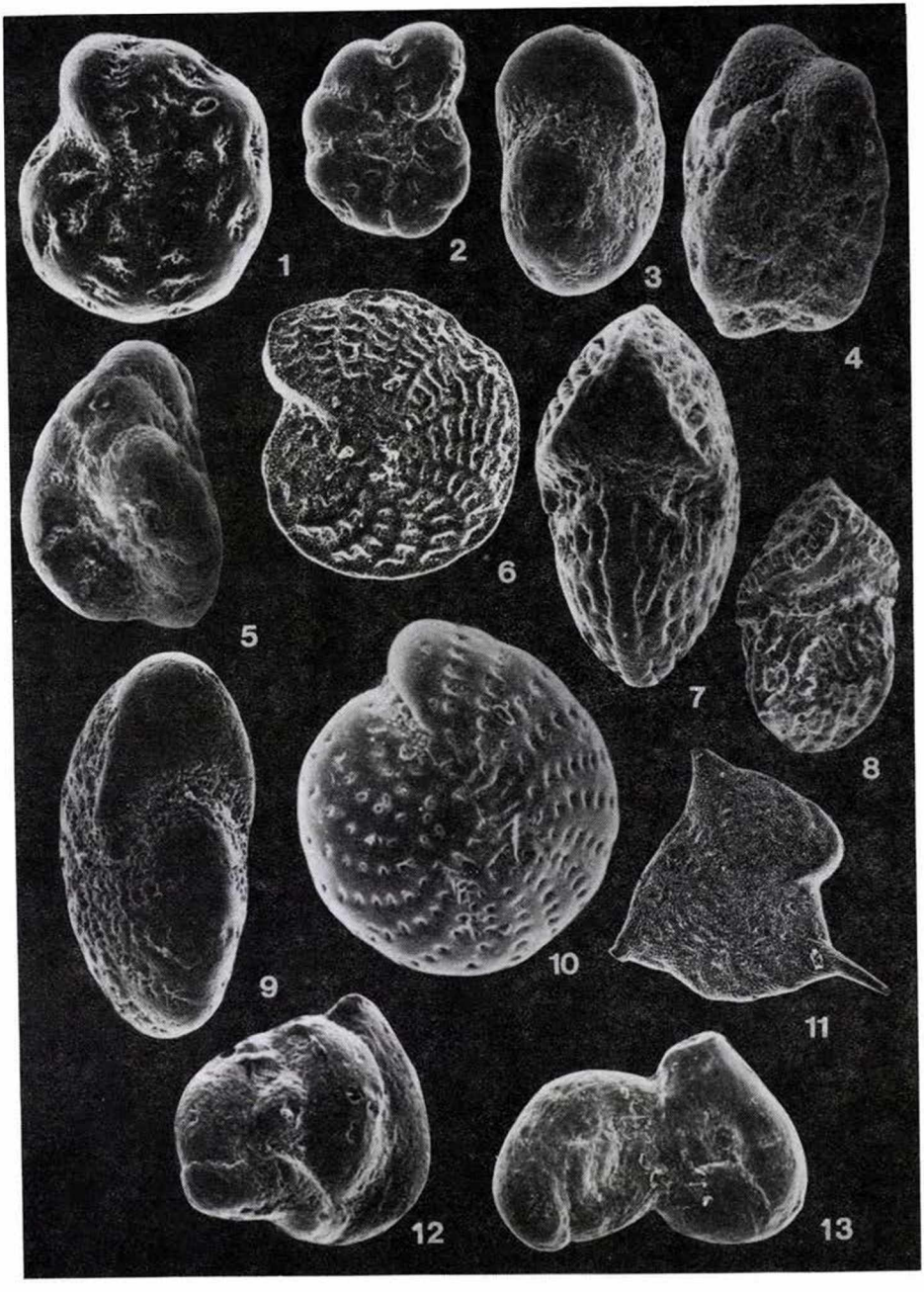
N: 30x

Fig. 12-13. *Miliolidea sp.*, Sarmatian, *Spirolina austriaca* zone, Perbál-5. borehole, depth 75.2-78.2 m;

12 - specimen with irregular chamber arrangement.

13 - twins specimen.

12-13 - N: 100x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